ORTHOPEDIC SURGERY

AND

OTHER MEDICAL PAPERS

BY

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BOSTON

LITTLE, BROWN, AND COMPANY

1900

University Press:
John Wilson and Son, Cambridge, U. S. A.

THE miscellaneous papers reproduced in this volume, most of them relating to Surgery, include the more important of Dr. Bigelow's contributions to medical journals. His Boylston Prize dissertation on Orthopedic Surgery is reprinted — as indeed are some of the other articles — chiefly for its interest as matter of surgical history.

Boston, 1894.

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ORTHOPEDIC SURGERY.

PREFACE.

THE works I have consulted in writing this dissertation are chiefly those of Guerin, Bonnet, Velpeau, Phillips, Duval, and Little; especially the *brochures* of M. Guerin, who has been for some time the leading French orthopedist.

The writings of M. Guerin may be fairly criticised, both for the wordiness and obscurity of their style and for their unnecessary bulk; but it does not appear that we have any right to question the accuracy of their statements. On the contrary, we may infer from the late report of the committee appointed by the Academy of Medicine to investigate this point, that there is no ground for supposing the evidence in any way warped or misrepresented.

It is possible that M. Guerin has availed himself of the suggestions of previous writers; that, in common with other specialists, he has overestimated the importance and the efficacy of his art; that he has been indiscreet in its application; and that "the division of forty-two tendons, muscles, etc. upon the same subject" was an audacious undertaking rather than "a remarkable achievement." But it should not be forgotten that the scientific acquirements and practical skill of this orthopedist are undisputed; that he is the author of valuable discoveries, confirmed as such by the Academy of Medicine, and that, much as he may be indebted to previous writers, the account has at least been squared by the compensating drafts of those who have followed him.

The article upon Strabismus, the first of this dissertation, is somewhat disproportioned in length to the subsequent sections. The materials were originally collected without the intention of incorporating them into this work. In allowing them to retain their present extent, I was decided mainly by the fact that no complete treatise upon this subject had appeared upon this side of the water. The same is true of the section on Stammering, the operation for which is now a matter of history, — a curious instance of the indiscreet zeal of some of the noted Continental surgeons.

ORTHOPEDIC SURGERY.[1]

INTRODUCTORY.

It is obviously difficult to procure evidence upon which a direct answer to the question proposed by the Committee should be based. The subject is comparatively new, and demands further investigation. Among its different departments, it is easy to show why the present operation for stammering should be proscribed; but it is not easy to indicate the cases which require a section of the muscles of the back, or of the tendons of the hands and fingers. These questions can be decided only by a careful analysis of a large number of cases, with reference to the pathological conditions of the subject, and the results of different methods of treatment. They have not been settled by those most conversant with this branch of surgery, and demand opportunities which are probably afforded only by the larger European institutions.

It is believed that the general intention of the Committee will be fulfilled by an attempt to cover the ground now occupied by Orthopedic Surgery.

[1] A Dissertation which obtained the Boylston Prize for 1844, on the following question: "In what cases, and to what extent, is the division of muscles, tendons, or other parts, proper for the relief of deformity or lameness?"

STRABISMUS.

But few years have elapsed since the operation for Strabismus was announced, under circumstances of considerable interest. It proposed the relief of an obvious and frequent deformity, with little pain or hazard to the patient, and at the same time promised to the surgeon the notoriety which attends a new and successful operation. Thus recommended, it rapidly gained ground, and was performed many hundred times in Europe and in this country, not only by competent surgeons, but by operators who either were not qualified to investigate the lesion from a scientific point of view, or whose interest it was to furnish incorrect or partial statements of their results.

Of the memoirs upon this subject, many offer a limited series of observations, inadequate for purposes of induction; others are manifestly inexact; and a still greater number are controversial essays, adapted to advance a particular method, or its advocate. The following details have been drawn from the few more authentic papers which have recently appeared.

ANATOMICAL CONSIDERATIONS.

The ball of the eye offers little worthy to be noted in connection with this operation. *The Sclerotic* is a dense, resisting coat, which may be freely denuded with probe pointed instruments without risk of perforation or other mechanical injury; neither does it readily become inflamed.

Vessels. — A case of alarming hemorrhage from the operation has been published in the English journals, and seems to have been the result of a decided hemorrhagic diathesis in the patient a child of eleven years of age. The hemorrhage

was arrested after the transfusion of several ounces of blood from the arm of a healthy adult. In a normal condition of the circulating system, the arteries of the orbit are not of a size to occasion danger or inconvenience from hemorrhage, while the veins in the region of the ethmoid bone are easily avoided.

Nerves. — It seems superfluous to suggest that the optic nerve, inserted somewhat nearer the inner than the outer angle of the eye, may be wounded by a deep and careless dissection upon the nasal aspect of the globe. An instance of its actual division in this way has nevertheless been reported. The internal, superior, and inferior recti muscles, and the inferior oblique, are supplied by different branches of the motor communis or third pair; while the superior oblique and external rectus muscle, each appropriating a separate nerve, are supplied by the fourth and sixth pairs respectively. No ill effect results from the section of the branches of these nerves at the point where the muscle is usually divided.

Muscles. — The four recti and two oblique muscles of the globe are the chief agents in the production of strabismus. The vivid red of the muscular fibre can, in most cases, be detected at the bottom of the incision, while the fan-like expansion of their tendinous insertions is often invisible among the surrounding tissues. The anterior tendinous fibres of the four recti muscles are inserted at the distance of two or three lines from the cornea, while other fibres attach themselves to the sclerotic, a line or two behind; so that the whole somewhat resembles in form the adhering tail of a leech, to which it has been aptly compared.

The superior oblique muscle springs from the fibrous sheath of the optic nerve, traverses the pulley at the upper and internal angle of the orbit, and, turning backward and outward, joins the sclerotic beneath the superior rectus muscle and a little behind its insertion.

The inferior oblique leaves the superior maxillary bone in the neighborhood of the lachrymal sac, and, retreating a little, winds outward round the globe of the eye, to be inserted upon its upper and external surface.

Aponeuroses. — Much attention has been directed of late years to this part of the anatomy of the eye, especially by Guerin, Velpeau, and Bonnet (de Lyons). Their researches have demonstrated two principal fibrous expansions.

The first, which lines the periosteum of the orbit, retreats upon the optic nerve behind, and being continued forward upon the eyelids to their free edges, envelops in this manner the whole contents of the bony orbit.

The second is in contact with the sclerotic, which it covers and protects as it were from the surrounding adipose matter. In front, it is reflected upon the internal surface of the conjunctiva, which it lines up to its insertion at the edge of the lids, where it unites with the aponeurosis of the bony orbit. Behind, it is prolonged upon the optic nerve, where it again joins the orbitar aponeurosis, with which it forms a shut sac, from which the globe of the eye is excluded, much as the intestine is excluded from the cavity of the peritoneum. This sac is traversed by the muscles, each of which, as it enters the cavity, borrows from it a fibrous envelope, which is reinserted at its point of exit. A tube is thus formed, which gives passage to the muscle without affecting the integrity of the sac.

It will be remembered that these aponeuroses are chiefly noted for the rôle which different writers have assigned them in ocular deformity, and the impediment they are supposed to offer to the various steps of the operation. They have also a certain influence in the normal movements of the eye, to be hereafter examined.

MOVEMENTS OF THE EYE.

Muscles. — The action of the recti muscles upon the ocular globe is easily understood; and I am not aware of any difference of opinion upon this point. If a single muscle acts, the pupil turns towards it, upon a vertical or horizontal line. If two juxtaposed muscles contract, the pupil moves obliquely in the diagonal of the forces thus applied. Less is known of the action of the oblique muscles, and, while eminent writers have cited a variety of evidence in support of their different theories upon this point, the contradictory character of their opinions leads us to doubt their accuracy. That certain forms of strabismus are said to require a division of these muscles is a sufficient apology for a somewhat detailed examination of the movements attributed to them.

The superior oblique draws the point of its sclerotic insertion towards the cartilaginous pulley, while the action of the inferior oblique is direct.

Cruveilhier ascribes to the superior oblique a simple action of rotation of the ocular globe upon its antero-posterior diameter, the eye being at the same time slightly carried forward in the orbit. To the inferior oblique he attributes a similar rotation in an opposite direction.

Velpeau supposes that the superior oblique carries the eye inward and downward; while at other times it rather aids the external rectus and inferior oblique in external strabismus.

Charles Bell has termed the superior oblique a respiratory muscle, from its supposed influence in raising the eye in the expression of certain emotions; as in sighing. In experiments upon the dead subject, he found the eye turned downward and outward by traction upon this muscle. As it antagonizes the inferior oblique muscle, he suggests that its involuntary relaxation in certain expressions gives an opportunity for the action of the latter muscle, which then rolls the pupil upward.

A later and more plausible theory of Guerin[1] and Skolaski[2] is supported by a number of pathological observations, and can easily be tested.

Examine the eyes of a person at a convenient distance, and draw imaginary horizontal lines through spots upon the conjunctiva. Let the head now be laterally inclined toward the shoulder, and it will be seen that the imaginary lines continue horizontal, and parallel with the floor or ceiling of the apartment, although their position in relation to the lids be changed; in other words, the eye tends, by a rotation upon its antero-posterior axis, to retain its relative vertical position. Whatever be the utility of such an involuntary movement, it must be allowed that it belongs to the oblique muscles, as supposed by these physiologists, although it attributes to the inferior oblique branch of the third pair of nerves the power of producing involuntary action.

Aponeuroses. — The aponeuroses are said to possess a certain influence upon the movements of the eye. In the lateral movements of the ball, the angles of the lids enlarge at the approach of the pupil; and certain writers have supposed this action to be due to a simple traction of that portion of the aponeurosis of the globe which is prolonged to the free edge of the lids. A permanent displacement of the eyeball would then occasion permanent traction of the lids.

But this explanation is open to objection. Were the harmony of action between the lids and the globe due to a purely mechanical influence of the fibrous tissues, it would follow, when the pupil is buried beneath the roof of the orbit, that both lids should be equally elevated by their respective aponeuroses. The pupil rolls thus upward in the involuntary motions described by Charles Bell, a fact verified by placing the finger upon the lids while they are forcibly shut. It is

1 Communication à l'Institut, Août, 1840.

2 Mémoire adressée à la Société de Médecine de Gand, 1840.

then observed that, while the pupil rises involuntarily, the upper eyelid falls, — an antagonizing action directly opposed to the upward traction of the ball upon the upper lid. The lower lid seems to be more directly attached to the globe. It follows the elevated pupil, and never antagonizes the superior lid so well as when the eye is rolled up beneath the orbit.

The importance of these aponeuroses in their healthy condition seems to have been exaggerated. It is, however, easy to suppose that bands of condensed cellular tissue might attach themselves to various parts of the orbit and globe, and tend to impede the free motions of the eye, especially were the globe retained, by muscular contraction or otherwise, in a given position for a length of time.

CAUSES OF STRABISMUS.

Strabismus is characterized by a want of harmony in the action of the eyes. The internal recti muscles alone possess the power of producing a voluntary strabismus, or, in other words, an exaggeration of the convergent action which directs both eyes towards a single object.

The duration of strabismus varies with its exciting causes.

One variety of the deformity depends upon a transient spasmodic action of the muscles. It is observed in many individuals while talking, and is sometimes of but momentary duration. Different exciting causes of this variety have been noticed: a moment of anger, an elevated temperature, a current of air upon the forehead, or any cause which acts upon the nervous system. Temporary strabismus has been known to precede the catamenial discharge, and has been observed in infants immediately before the development of dentition.

Another variety accompanies apoplexy, or other grave lesions of the brain; while a third class result from tumors in the soft or bony tissues of the orbit; in which cases the

deformity is symptomatic, and directs attention to the more serious affection.

There are, however, certain forms of strabismus less immediately connected with important organic lesion, which depend upon the physiological conditions of the surrounding tissues. In these cases the affection may originate in the muscles, or the nerves which supply them; or result from a derangement in that part of the machinery of the eye which is directly concerned in the sense of vision.

Muscular Contraction.—While the operation was yet new in England, Sir Astley Cooper remarked to the writer of this paper that he believed it would not generally succeed. Correction of the deformity of a limb was mainly due to treatment after operation, but the nature of the eye forbade the application of an efficient orthopedic apparatus. Strabismus has been elsewhere termed club-foot of the eye; but the condition of the parts is not such as to warrant this comparison. If a club-foot be examined, the retraction is found to be firm and permanent. The foot yields very little to the application of a considerable force. But if in a common case of ocular deformity the sound eye be closed, it will be found at the end of a certain time that the pupil of the affected eye emerges from the angle of the lids and advances to take its place in the centre of the orbit, while the sound eye is in its turn everted. In the former case the muscle has lost its power of elongation; it often undergoes a transformation which assimilates its substance to that of fibrous tissue. In the eye, on the other hand, the muscle retains its anatomical structure, and such a transformation is very rare. In four hundred and twenty-two cases operated upon by Phillips, fibrous transformation occurred three times; while in more than five hundred patients only two cases of fatty transformation were observed.

What then is the condition of the muscle in the majority

of cases? Accumulated testimony seems to warrant the assertion, that the muscle is in a condition of permanent but active contraction; an explanation readily accepted, when it is remembered that a great number of cases are sudden in their access, and date from the convulsions of infancy.

Optic Strabismus is a term applied by M. Guerin to the deviation which sometimes follows distortion of the pupil, or opacities upon the cornea in the axis of vision. As the rays of light are thus hindered from reaching the retina in a direct line, the eye deviates from a central position in such a way as to present either a transparent portion of the cornea, or the pupillary aperture, directly to the object. Although these cases are not uncommon, every surgeon has observed central opacities of the cornea without ocular deviation. M. Guerin supposes that this sort of distortion forbids operation. On the other hand, M. Velpeau affirms that the deformity presents no greater tendency to reappear in these cases than in others, and in balancing the amount of vision obtained by the deformity against the personal attractions lost by it, he considerately submits the question to the vanity of the patient. Surgeons having thus acquired the power of correcting strabismus at the expense of the sight, it obviously remained for some ingenious oculist to reverse the process and restore the vision by producing a squint. This has been done by M. Cunier. He proposes,[1] in cases of central opacity of the cornea, to divide one or more muscles of the eye, so as to determine a strabismus which shall put the pupil in relation with that portion of the cornea which remains transparent, and thus permit the light to arrive at the bottom of the eye.

Strabismus from Muscular Paralysis. — The affection which gives rise to this form of strabismus has received much attention of late years from ophthalmic surgeons, and especially

[1] Lettre à l'Académie des Sciences, 1841.

from M. Sichel. Its effect is analogous to the distortion observed in the extremities when the paralysis of certain muscles is followed by the unopposed retraction of their antagonists. It occurs in certain cases of a paralytic affection of one or several of the muscular fasciculi. If the external rectus be alone involved, the eye deviates to the side of the nose. If the internal rectus be affected, external strabismus is the result; and the eye turns up or down, as the inferior or superior straight muscles cease to act upon it.

An affection of the third pair of nerves sometimes occasions paralysis of the three muscles which it supplies, and the external rectus alone retains its power.

Distortion of this sort is distinguished from common strabismus by the inability of a patient to direct his eye towards the affected side when the other eye is closed. The deviation is sometimes slight, and the eye merely refuses to follow its companion in certain directions, while otherwise it moves freely. It is less easy to distinguish a paralysis of several muscles from that form of strabismus which results from adhesion of the surrounding tissues and immobility of the eyeball. A degree of motion, however, exists in most cases, and were there none the former might be distinguished by its capability of passive or forced motion, which the fixed immobility of the other forbids.

These varieties of strabismus have been subjected to operation. It is, however, evident that remedies should be directed to the original lesion, so long as they promise a chance of relief. If the case assume a chronic form, beyond aid from remedial agents, an operation may be resorted to, with a view of restoring the eye to the centre of the lids. It is sometimes accompanied with advantage to the sight, but is more frequently an operation *de complaisance.*

Paralysis of the Oblique Muscles is more difficult of diagnosis. Two cases, probably of this affection, reported by

M. Skolaski,[1] seem to confirm the supposition already referred to, that these muscles exercise an action of rotation upon the eyeball. In both these interesting cases, the eye refused to imitate the rotatory motion of its fellow when the head was turned towards the shoulder, and in this position diplopy ensued. The images were superposed, and mutually receded in a vertical direction as the head was inclined, that of the stationary eye being always below.

The various duties assigned by different observers to these muscles have been enumerated at some length in another part of this paper; and it has been seen that the most contradictory opinions have been entertained of their real purpose. It cannot, therefore, be shown what variety of distortion would result from their permanent contraction. In fact, they have often been divided for strabismus; but the results of the few trustworthy observations upon this point are so widely opposed that their section must be regarded, at present, as purely experimental.

Strabismus from Amaurosis. — Functional or other lesion of the optic nerve has been considered both as a cause and an effect of ocular distortion. It is undoubtedly true that amaurotic eyes are not exempt from the various distortions which affect these organs. If amaurosis is a cause of strabismus, restored vision will probably rectify the deviation. The effect of the operation upon amaurosis will be again adverted to.

DOUBLE STRABISMUS.

In most cases of simple strabismus if the patient be directed to regard a distant object he does so with the sound eye, while the affected eye squints. The sight of the deviating organ is often imperfect. It is not uncommon to meet with patients

[1] Longet, Anatomie et Physiologie du Système Nerveux, Paris, 1842, tom. ii. p. 396. (See *ante*, p. 8.)

who have acquired a habit of using the sound eye for more remote objects, while the squinting and often near-sighted eye is reserved for reading or viewing objects close at hand, and a singular effect is produced by their ability to advance either pupil at will. But it sometimes happens that both eyes present a slight deviation. In such cases the operation should be confined to that which presents the greatest distortion. A month should be allowed to elapse before operating upon the second, as during that time, in a majority of cases, the movements of the two eyes become parallel.

Velpeau concedes that it is difficult to distinguish cases of really double strabismus from those which are so only in appearance and which demand but a single operation to correct an apparent double deformity. M. Phillips operates upon both organs only when the deviation in the two eyes is uniform, and then only at an interval of a month or more.

ANATOMICAL PECULIARITIES.

Adhesions of the Globe give rise to permanent strabismus, distinguished by its incapability of passive or forced motion. These cases result from wounds and deep-seated inflammation of the orbit. Velpeau alludes to cases not referable to such conditions, in which the muscle adhered to the sclerotic as far as the posterior part of the eye. The operation requires extended dissection, and is liable to be followed by readhesion. Successful results have, nevertheless, been reported by Velpeau and others.

Triple Insertion. — The internal and superior recti muscles are, in rare instances, divided into two or three fasciculi at their then fanlike insertions, either of which may aid in producing a deviation.

Fibrous and Fatty Transformations of the muscles are rare, and have been elsewhere mentioned.

AGE.

Neither infancy nor old age has been exempted from this oft repeated operation. In young infants the deformity sometimes disappears spontaneously, while old people rarely care to be relieved of it. After the age of three or four years the chances of success are greater in proportion to the youth of the patient. M. Velpeau asserts that the tissues require a more extended division in old people.

OPERATION.

Though definitely indicated by Stromeyer, in 1838, and performed upon the dead body by that surgeon, the operation for strabismus was first applied to the living subject, in modern times, by Dieffenbach, on the 26th of October, 1839.

It is probable that a similar operation was practised many years ago. The following curious advertisement of an English oculist, named Taylor, who lived in the last century, is to be found in the "Mercure de France," Année 1737, Juin, p. 1180: "Doctor Taylor, Oculist of the King of Great Britain, has recently arrived at the Hôtel de Londres, Rue Dauphine, Paris, where he proposes to stay till the beginning of July, after which he will leave for Spain. He begs us to publish the discoveries he has made to restore squinting eyes by a rapid operation, almost without pain, and without fear of any accident."

M. Cunier[1] refers to a singular phrase in the dissertation of Verheyden, printed in 1767: "Strabones permultos ferro sanatos apud Anglicos vidi."

Whatever be inferred from these passages, the operation was unknown to surgeons at large until of late years.

M. Carron du Villards pretends to have thought of it in 1838.

[1] Annales d'Oculistique, 1er Vol. Supplémentaire, Bruxelles, 1842, p. 258.

Dr. Ingalls, of Boston, Massachusetts, is said to have suggested it as far back as 1812–13.[1]

Pauli, a surgeon of Landau, in 1839, was only prevented from attempting it by the indocility of his patient. But the first authentic operations upon either the dead or the living subject belong to the surgeons of Hannover and Berlin.

A few months sufficed to introduce this surgical novelty into England and France. I was present in September, 1840, at some of the earliest experiments made in London. The simplicity and safety of the operation soon became known, and the new ground was at once occupied by a host of explorers striving to identify themselves with its success. All were armed with peculiar and indispensable instruments, with curious hooks and complicated scissors, and with knives studiously fashioned to differ from one another. The method continually varied; and there were few surgeons who had not an operation of their own, distinguished by their name.

The general principles of these different methods are the same; and I propose to examine them under the three following heads: —

Those which resemble the operation of Stromeyer and Dieffenbach, in which the conjunctiva is first divided.

Those in which all the tissues are divided at once, as in the method of Velpeau.

The subconjunctival method of Guerin.

In each method the aim of the operation is the division of the muscle, and it is of little real importance whether it be effected in one way or another. But there is hardly a surgeon or an oculist who has not suggested some superfluous modification or complication of this simple manœuvre; and within a week I have observed in one of the journals the reinvention of an instrument contrived some two years since. In the words of Mr. Liston, "All this is for the use of those

[1] Medical Examiner, February, 1841.

gentlemen practising surgery who are deficient in dexterity, and for the benefit of the cutlers." A somewhat tedious examination of the more important methods, if it serve no other purpose, may tend to show that there is little new to be contrived either in the instruments or the manual of this frequent operation.

For greater convenience the operation is, in general, described with reference to convergent strabismus of the right eye.

Operation of Stromeyer.—The sound eye being covered, the patient is directed to turn the affected eye outward. A small double hook is implanted in the conjunctiva at the internal part of the globe, and confided to an aid. The fold of conjunctiva is then raised with forceps near this point, and divided vertically with a cataract knife; after which the aid draws the eye outward, while the surgeon passes a small curved director underneath the muscle, and divides it with the knife or curved scissors.

It should be remembered that, in operating upon the dead subject, Stromeyer was not compelled to confine the lids.

Dieffenbach's Method is similar, but characterized by a greater complication of instruments, and requiring more assistance. The instruments are the elevator of Pellier for the upper, and a double blunt hook with a long slender handle for the lower lid; two slender hooks to pierce and raise the fold of conjunctiva; scissors curved on the flat, to divide the conjunctiva and the muscle; a blunt hook to insinuate beneath the muscle; and finally, in refractory patients, a double short-pronged hook, to pierce the sclerotic and confine the eye. Two assistants in general suffice. The patient is seated opposite the light, the head resting upon the chest of an assistant. The surgeon sits in front of the patient, without excluding the light, and, passing the elevator beneath the upper lid, transfers it to his assistant. The double hook depresses

the lower lid, and is held by the second assistant, who kneels. The fold of conjunctiva is now suspended between the two small hooks; the first, at the inner angle, being confided to the first assistant, while the second, near the cornea, is retained by the operator in his left hand. The fold is snipped with curved scissors, and the muscle exposed by dissection. The surgeon then abandons the scissors, introduces the blunt hook beneath the muscle, and, as a final step, divides it with the scissors.

In some of his earlier operations, Dieffenbach excised a portion of the tendinous extremity of the divided muscle, but subsequently renounced this process.

The Operation of Phillips, a pupil of Dieffenbach, is nearly identical with the preceding.

Guthrie's Method. — In the operations which I saw performed by Mr. Guthrie in September, 1840, the manual resembled that of Stromeyer. The lids being controlled by instruments, or by the finger of the operator and that of an assistant, the sclerotic was transfixed by a double hook, and the eyeball everted. The conjunctiva being then raised upon a hook and opened, a slight dissection exposed the muscle. A curved director was now passed beneath the muscle, and served to guide a short pointed and curved bistoury in dividing it.

Methods of Ferral and Lucas. — These differ little from that of Dieffenbach. In that of Ferral, the forceps are substituted for one of the conjunctiva hooks, and angular for curved scissors.

Liston's Method. — With a view of dispensing with one assistant, this surgeon proposes to fix the eye and raise the conjunctival fold by a pair of spring toothed forceps, which, once attached to the conjunctiva near the inner angle, are left to themselves and by their weight confine the lower lid.

The Methods of Roux and of Sedillot resemble that of Guthrie in the use of the curved director. To fix the globe,

M. Sedillot employs a hook with three branches, each furnished with a small sphere like a shot at the distance of a line from its point, to prevent it from penetrating the sclerotic too deeply.

Baudens's Method.—The lids being fixed as in Dieffenbach's operation, the surgeon transfixes with a strong single hook both the conjunctiva and the muscular attachment. The eye is then drawn outward, and the muscle rises in a plait or fold. Under this he inserts M. Baudens's knife, and divides the mucous coat together with part of the muscle. The remainder of the muscle is raised with a blunt hook, edged upon its lesser curve, which thus severs its fibres. M. Baudens removes the tendinous insertion, and also trims the conjunctival edges, with a view to relieve the wound of filaments which might impede its union.

The knife of M. Baudens (Fig. 4) is about an inch in length and a quarter of an inch wide at the base, and pointed. It is curved on the edge to about a quarter of a circle. It is also slightly curved upon the flat, and the point is thus directed away from the globe of the eye, while the wedge shape of the blade enables it to cut its way out in traversing its length. It is evident that a different curve is required for each eye.

Method of Amussat. — This differs little from those already cited, except in the blunt hook inserted beneath the muscle. M. Amussat has contrived an instrument consisting of two hooks lying side by side, and so adapted to each other as to resemble a single one. These hooks, introduced between the muscle and the eyeball, are then opened, and the muscular fibres divided between them. M. Phillips asserts that this instrument was previously invented and rejected by Dieffenbach.

Finally, M. Gairal has proposed a hook armed with a button and bent at right angles; the distance from the elbow of the hook to the button being four lines. This serves to designate

the position of the tendon in measuring the distance between its insertion and the edge of the cornea. Introduced beneath the muscle, the arm of the instrument is sufficiently long to embrace the fibres in all their width.

OPERATION IN WHICH ALL THE TISSUES ARE DIVIDED AT ONCE.

First Method of Velpeau.—The lids being held apart by instruments, a double hook is plunged into the sclerotic near the cornea, and the eye drawn outward. A strong, single hook is thrust under the muscle near the angle and a fold thus raised. With a small curved knife the entire fold is divided, consisting of the muscular fibres, cellular tissue, and the conjunctiva.

M. Andrieux proposes to give the hook an edge upon its lesser curve, which would then cut its way out.

Second Method of Velpeau.—The lids are separated by a self-adjusting speculum termed a *blephareirgon* (Fig. 13), invented in England and modified by M. Velpeau. With a strong pair of toothed forceps, the surgeon seizes the insertion of the tendon and everts the eye. With a similar pair, which he afterwards abandons to an aid, he grasps the muscle and conjunctiva at the angle. He then divides the muscle and surrounding tissues near its middle with a pair of curved or straight scissors, the blunt points of which are repeatedly passed backward and forward upon the sclerotic, to plough up any accidental undivided fibres. A last stroke of the scissors excises the tendinous insertion, and its conjunctival covering, still retained by the forceps.

This operation, which I have repeatedly seen performed by M. Velpeau, involves a free division of the tissues surrounding the retracted fibres.

The teeth of forceps intended to grasp the tissues exterior to the sclerotic should be slightly recurved, that their convexity may repel this membrane when pressed against it,

while their approaching extremities pierce the tissues in immediate contact with them.

M. Velpeau sometimes uses but one pair of forceps, and the operation then resembles that proposed by M. Daviers (d'Angers).

A sponge is often required during the operation, and a pair of slide forceps has been contrived to hold it, attached to the handle either of the knife or the scissors (Fig. 4).

SUBCONJUNCTIVAL METHOD.

Applying to the eye the principles of subcutaneous operations, M. Guerin has adopted a process which, though somewhat complicated, deserves attention.

The instruments in this operation are peculiar. A spear resembling a saddler's awl, whose greatest width is rather less than a quarter of an inch, an inch in length, and slightly curved upon the flat that it may follow the ocular sphere, serves to pierce the mucous envelope.

The shaft of the knife employed is first bent to a right angle, and then rebent to its original direction at the interval of about an inch (Figs. 6, 7). Two elbows are thus formed, to one of which is attached a strong handle, while the blade at the other is an inch in length and slightly convex on the edge. They allow the handle of the instrument to lie flat upon the cheek or forehead of the patient, while the blade is beneath the muscle to be divided, and perpendicular to its fibres. In other words, the bend in the shank of the knife adapts it to the depression of the eye beneath the orbitar ridge.

The manual is as follows. The patient lies upon a table, the head supported by a pillow, while the lids are confined by any of the common means. A double hook is plunged into the sclerotic near the cornea, and when the eye is everted abandoned to an aid. A fold of conjunctiva is now raised

near the insertion of the tendon with a hook, which the operator holds in his left hand, while with his right the spear is carefully passed to the depth of half an inch along the inner surface of the muscle, and then withdrawn. The operator then directs the blunted point of the knife towards the occiput, enters it at the aperture, and engages it beneath the muscle. As a second step, he depresses the handle upon the cheek, so that the blade lies across and beneath the muscle, while the shank of the knife, between its elbows, is engaged in the small conjunctival aperture. By a third manœuvre, he turns towards the muscle the edge, which previously looked towards the occiput. Extracting the now useless hook from the conjunctiva and taking in his left hand the sclerotic hook from the aid who has held it, he gently draws the eye outward, while with his right he severs the muscle by a sawing motion of the knife. Its division is attended with a slight noise, audible at some distance. The surface of the eye is then explored, by ploughing its surface, as it were, with the blunted point of the knife, and thus any remaining fibres are divided. The instrument is withdrawn with a movement the reverse of that by which it entered.

Such is the operation in which I have often assisted M. Guerin. With a little manual dexterity it is quite simple, and seldom occupies more than half a minute in its execution.

APPRECIATION OF THE DIFFERENT METHODS.

Before examining the details of the operation, it will be well to determine as nearly as possible the conditions most important to its success. At Paris the early operations of MM. Roux, Sedillot, and others were eminently unsuccessful. Of ten cases reported by M. Velpeau, three only were radically cured of the deformity. When the method of

Dieffenbach was better understood, results were more favorable. Phillips, a pupil of this surgeon, operating in the presence of Amussat, Baudens, and Lucien Boyer, obtained from them the avowal "that they at last understood why until then they had only met with failure; and they, with reason, referred the constant success of this operation to M. Phillips's use of the blunt hook of Dieffenbach in searching for the contracted muscle."

It will have been observed from what has preceded that the chief use of the blunt hook (*crochet mousse*, Fig. 5) is in searching for such undivided filaments as may have escaped the first division of the muscle. Its blunt point is repeatedly passed backward and forward, up and down, in a direction perpendicular to that of the muscular fibres; and being urged against the sclerotic it seldom fails to insinuate itself beneath the tissues nearest in contact with this membrane, which are then easily raised and divided.

To a similar cause M. Velpeau attributes his want of success, as will be inferred from his remarks upon the operation of M. Phillips: "Seeing M. Phillips operate upon the dead subject, I at once understood that, in imitating him, we could hope to succeed where we had before completely failed. In fact, observing that he divided the conjunctiva and all the tissues contained in the orbit, over at least a third of the surface of the globe of the eye, I perceived that among my patients numerous layers destroyed by M. Phillips must have remained in place. For my part, I had not dared, at first, so largely to denude the sclerotic, or to perform a dissection in the orbit at once so extended and so profound. I avoided this with extreme care, and aimed especially to confine the division of the conjunctiva and the other tissues to a very limited extent. The fear of seeing a phlegmonous inflammation establish itself in the orbit did not permit me to go further. M. Phillips having affirmed that the conse-

quences of such extensive denudation, and of a division of the tissues which had alarmed me upon the living subject, were extremely simple and involved no serious accident, and having soon after demonstrated the truth of his assertions in operating upon patients, my convictions were changed, and the question soon assumed a new phase."

A complete division of the parts is then the great aim of the operation; and it is safe to assert that, so long as any contracted filaments remain undivided the success of the operation will be compromised. A partial section may in some instances suffice; but at present it is impossible to distinguish such cases, or to designate in the orbit the particular fibres concerned in the deformity.

In dissecting perpendicularly down upon the sclerotic we endanger its integrity. It is therefore necessary to interpose something between this membrane and the parts immediately in contact with it, by which they may be at once discovered and commanded. Now it is of little consequence whether this be effected by any of the numerous blunt hooks of different operators, by the probe-pointed blade of curved or straight scissors, or by the rounded tip of M. Guerin's knife. The type and element of the instrument employed is the blunted hook, *crochet mousse* of Dieffenbach; split longitudinally, and attached to the crossed legs of the common forceps, it becomes the *crochet à écartement* of Dieffenbach and Amussat; furnished with an edge upon its inner curvature, it is the *crochet bistouri* of Baudens; armed with a point and curved, it is the *crochet tranchant* of M. Andrieux, the *myotome à double courbure* of Baudens, and the common curved bistoury of other surgeons. It is also recognizable in the blade of common curved scissors, which, in the hands of M. Velpeau, are straight; while with M. Guerin a knife attached to a crooked handle answers the purpose.

This step of the operation I consider essential. The

manual varies with the taste and habits of different surgeons; but in every method there is a blunted point thrust between the sclerotic and the last undivided fibres. These, being once discovered and elevated, are easily cut if raised upon the blunt hook by a knife or scissors, or by the sharp edge of the hook itself, if it have one. They are equally well divided between the arms of the *crochet* of Amussat, by the twin blades of scissors, and finally, in the subcutaneous operation, by the edge of the tenotome.

The other parts of the operation may be considered in their order. The upper lid is, in general, better held by the common elevators than by the finger of an assistant, though the latter is often sufficient. As in other operations upon the eye, the finger should be covered with cotton cloth, which absorbs the secretions and maintains a better hold upon the lid.

The lower lid may be confined by the forefinger of the operator's left hand, or by a double hook held by an aid. The forceps of M. Liston attached to the conjunctiva are painful, and should only be employed when other assistance is not at hand.

Snowden's *blephareirgon* appears to offer the most effectual and simple means of fixing the lids. The metallic band attached to it by Charrière is unnecessary and inconvenient. The pain it occasions is slight, and the instrument makers are in the habit of applying it to their own eye to show its efficiency. It might be rendered still less painful by a thread confining the arms, so as to prevent their diverging beyond a certain point.

In most methods the globe is commanded by a small double hook, which penetrates the sclerotic. It should be fixed by a sudden stroke, as in entering a cataract needle. In case of failure with it the wounded eye should be allowed a short repose, as it often takes on a convulsive action and

becomes difficult to manage. This hook offers several advantages. While it controls the eye it enables the surgeon to extend or relax the contracted tissue as he secures and divides it. In the method of Dieffenbach the eye is less securely held by a flap of conjunctiva.

The conjunctiva may be raised by hooks or toothed forceps,—hooks being less painful, forceps more secure. If the conjunctiva be alone transfixed one or two hooks may be used at the taste or discretion of the operator; but when all the tissues are to be included in the fold two forceps are evidently more effectual, though M. Velpeau occasionally employs but one.

The incision of the conjunctiva when near the cornea is less liable to be followed by gaping of the lids and depression of the caruncula than when near the angle of the eye. If prolonged upward it should terminate as near as possible to the lower edge of the muscle. The division of the aponeuroses downward tends to induce a fall of the lower lid, and a consequent enlargement of the palpebral aperture.

The length of the incision varies in different methods. While M. Phillips denudes a third or more of the ocular circumference, M. Guerin insists upon the advantage of a simple puncture of a size to admit the instrument. The truth lies between these extremes, and it may be affirmed that an incision of about half an inch in length suffices in most cases for convenience of manipulation and to expose the tissues to be divided. Its length necessarily varies, and in general increases with the degree of the deviation.

The cellular tissue once divided and the red substance of the muscle brought into view, or its position exposed, its fibres are raised by an instrument passed beneath it in the manner before indicated. Premising that the blunt hook requires least dexterity, we may leave the instrument to be employed to the option of the surgeon.

It is during this dissection that the sponge is required; and it is most convenient when attached to the handle of the cutting instrument.

With the self-adjusting speculum, the operation of M. Velpeau, which embraces at once the tissue to be divided, is rapid and simple. The use of toothed forceps is perhaps more painful than that of single hooks, but the whole method is more expeditious. I have repeatedly seen children undergo the operation without manifesting pain.

The removal of the end of the divided tendon is of doubtful efficacy. Adopted and rejected by Dieffenbach, it is now practised by Velpeau and by Phillips, but it is not essential to success. It is affirmed by these operators that, in precluding the possibility of union by first intention, the excision of the tendon reduces the chance of a return of the deformity. Phillips asserts that it never causes accident, is not painful, and that it diminishes the quantity of exuberant granulations.

The subconjunctival method of M. Guerin has been much decried. Its results, of which I have seen many examples, have appeared to me quite as successful as those of other methods, although I have no statistics upon this point. The manual dexterity requisite for its performance has prevented its general adoption, and has probably interfered with its success in other hands than those of its inventor. Nevertheless, it has often proved efficient among skilful operators. It may be mentioned that Dr. Cabot of Boston obtained excellent results from this method in Yucatan. The sclerotic surface should be carefully explored for undivided fibres while the globe is rolled inward with the sclerotic hook and the fibres thus relaxed. When the knife penetrates beneath them, they are to be extended across its edge and severed. This method is often followed by much ecchymosis, which is afterwards absorbed. On the other hand, the open wound

of the common method is soon occupied by a bunch of fungous granulations, from which the narrow puncture of Guerin's operation is exempted.

The matter may be thus summed up: —

The retracted filaments are to be completely divided.

They are best detected with a blunt hook, or analogous instrument, insinuated beneath them.

The other steps of the operation are dictated by the inclination or habit of the surgeon.

The simplest method is that of Velpeau.

SUBSEQUENT TREATMENT.

It will be readily conceived that the treatment should bear some proportion to the extent of the incision and of the probable inflammation. In many cases the patient continues his ordinary avocations without inconvenience, while in some rare instances a violent inflammatory action ensues. In general, compresses wet with cool water suffice as an immediate application to the eye. In two days warm emollient lotions may be substituted, and at the end of three or four days a few drops of some mild astringent collyrium may be instilled day and night into the angle of the eye. Attention being paid to cleanliness it is rare that more violent remedies are called for, and the organ, if carefully watched, may be sometimes left to itself.

If the inflammation tends to gain the cornea, leeches or a cathartic are indicated; in short, ordinary remedies are to be proportioned to the violence of the symptoms. Sometimes a few hanging filaments of the conjunctiva serve to keep up irritation, and require excision.

Exuberant Granulations. — A few days after the operation, if the incision has been large, the mucous membrane presents a number of small elevated papules, somewhat resembling bubbles of air. Insensibly increasing in size, if kept wet

with cold compresses, they unite, become red and gorged with blood, and tend to excite a suppurative action of the adjacent surfaces. If the cold application be now discontinued the excrescence becomes rounded, smooth, shining, of a pearly color, and finally pediculated at the base, when it may be snipped off without inconvenience.

When not treated by wet compresses the granulations sometimes refuse to unite. Then they require to be excised separately, often with considerable hemorrhage, and are liable to be reproduced.

Cauterization, a more painful and prolonged procedure, is sometimes followed by cicatrices with more or less retraction of the tissues.

THE DEFORMITY AFTER OPERATION, WITH ITS SUBSEQUENT TREATMENT.

In a large proportion of cases, when the operation is well performed, the deviation is at once corrected; and though the eye may be unable to move in the direction of the divided muscle, the pupil assumes a position in the centre of the palpebral aperture. But this is not a constant nor always a permanent result.

In certain cases, the strabismus, though less marked, is still perceptible. The sclerotic has been laid bare in the region of the retracted muscle, but the eye still deviates in that direction, and further treatment is required to correct the deformity. Various methods have been devised for this purpose.

Division of Other Muscles. — It has been shown that the division of the oblique muscles is uncertain in its results.

Phillips divides the superior oblique when with strabismus the cornea is convex, and the eye salient and near-sighted. M. Velpeau has never divided it, and states that he knows no authentic and conclusive fact in favor of its section.

Equally experimental is the division of certain fibres of the neighboring recti muscles. M. Velpeau proposes to sever the inner fibres of the superior or inferior straight muscles in convergent strabismus, and cites successful cases of these supplementary sections. It should be remembered that, while it multiplies chances of success, a free dissection exposes the patient to a variety of serious accidents. It is not unfrequently followed by exophthalmy, divergent strabismus, or fixed adhesion of the globe, and is for this reason rarely justifiable.

Loop of Thread. — Dieffenbach seizes with forceps a fold of conjunctiva, with its subjacent cellular and fibrous tissues, and passes through it a thread, which is subsequently made fast to the nose, brow, or ear of the patient. The eye is thus retained in a normal position during four or five days, at the end of which time the thread cuts its way out. This method is, for obvious reasons, difficult of application.

Compression. — The convexity of the cornea affords a point of resistance by which the eyeball may be in some sort fixed. The lids should be closed, and a small, soft, globular compress placed at the angle from which the pupil is to be diverged. It is retained in place by a bandage around the head, which is made to exert a slight degree of compression in the desired direction.

It should be mentioned that an unskilful application of this bandage in the service of M. Velpeau was followed by phlegmonous erysipelas and destruction of the eye.

Spectacles. — An advantageous recourse frequently employed by M. Guerin consists of glasses, upon which paper is pasted so as to obstruct vision, except at a point distant from the divided muscle. The pupil seeks the light, and the eye is thus kept in a favorable position.

If often suffices to cover the sound eye, and thus force the patient to exercise the other.

Lastly, a slight deviation not unfrequently disappears without care on the part of the surgeon.

In another class of patients, the deviation, corrected at the time, tends to return at an interval of from one to four weeks after the operation. The same methods are here advisable; especially that of bandaging the sound eye, the use of covered glasses, or a bit of pasteboard bridging across the orbit, permitting vision only at the point required.

A Second Operation. — If the wound has healed, it becomes a question whether a second operation is indicated. For results of such cases the reader is referred to the numerous papers of writers upon the subject, each of whom emulates the other in successful operations upon the uncured patients of rival surgeons.

When none of the accidents to be hereafter mentioned have followed a first operation, it is probable that no ill effect will result from its repetition, which is better worthy of trial when there is the chance that a previous operation was incomplete.

BAD RESULTS OF THE OPERATION.

Among the bad effects of a large division of the tissues are the following: —

Strabismus in a Direction opposite to that of the original Deformity. — This demands the reverse of the treatment before indicated for a partial correction of the deviation. A compensating operation upon the contracting muscle has also been resorted to, but this, while it may relieve the deformity, tends to abridge the lateral motions of the eye.

Exophthalmy. — The ocular globe, deprived of a considerable portion of its muscular and tendinous attachments, advances in the socket, either upon its antero-posterior axis or with a lateral inclination. An unsightly deformity is

thus produced which is beyond the aid of art. In certain cases, when slight, and when it occurs immediately after the operation, it subsequently disappears.

Depression of the Caruncula often accompanies the last deformity, but more frequently exists alone. It is less liable to occur when the incision is made near the cornea than when at the angle. It is irremediable.

Gaping of the Lids sometimes occurs when the dissection is extensive. Phillips pretends to avoid this accident in many cases by prolonging the conjunctival incision downward no farther than the centre of the muscle.

If the falling of the lower lid be considerable the deformity can only be remedied by a corresponding modification of the other eye. For this purpose the mucous coat is seized by two hooks near the insertion of the inferior straight muscle, and incised. The unsupported lid then falls, and the similarity of the eyes renders the deformity less obvious.

Immobility of the Globe. — When a single muscle has been divided the movements of the eye, impeded at first, tend to re-establish themselves at a subsequent period. If two muscles are divided it is probable that the movements will be less completely restored; and when the denudation is considerable the eye inclines to contract firm adhesions to the surrounding tissues, which terminate in an incapability of motion, more or less complete, with or without strabismus. It is analogous to that produced by deep-seated inflammation, which has been before described.

Diplopy. — Double vision not unfrequently follows the operation, and disappears in most cases in three weeks or a month, provided the pupils assume a normal position.

CICATRIZATION OF PARTS AFTER THE OPERATION.

Until recently, little has been established upon this point. From the comparatively few authentic recorded observations the following principles are drawn: —

If any undivided fibres retain the muscle in place the severed ends are apt to reunite.

If completely divided the posterior portion retracts, and in rare cases is inserted by muscular adhesion into the sclerotic, at a point remote from its original insertion.

More commonly the divided muscle contracts tendinous adhesions with the sclerotic near the extremity of its transverse diameter, and becomes united to the anterior portion by fibrous prolongations which are firmly attached to the ocular globe.

DIMNESS OF VISION.

Dimness of Vision is a frequent companion of strabismus, and has been considered its effect.

It is certain that in the common form of strabismus, when the disabled eye is brought into use, it acquires in a large majority of cases a new and often complete power of vision. This improvement is sometimes immediate, and sometimes gradual.

The enfeebled sensibility of the retina is occasionally so considerable as to have been mistaken for amaurosis. It is not, however, a contra-indication of the operation, as it results in a great number of cases from the deformity itself.

MYOPY.

Internal Movements of the Eye. — It is evident that the internal relations of the different parts of the eye must be changed in order to obtain successively a correct image of a near and of a distant object. This alteration is difficult

to appreciate, and theories upon the subject have not been wanting. The convexity of the cornea has been supposed to vary, the humors to change their form, the crystalline its figure, and more recently its position. Perilenticular canals have been demonstrated,[1] which, with that of Petit, serve as safety valves for the temporary escape of the fluids compressed by the movements of the lens. If this action is obscure, its immediate cause is much more so, and is not clearly shown to depend either upon the oblique or the recti muscles exclusively, as different writers have suggested.

In the experiments of M. Bonnet[2] upon the eye of an albino rabbit, a distinct image of a distant window was obtained upon the retina. The eye was then laterally compressed, and while the first image was obscured that of a neighboring lamp became distinct. The experiment being repeated, it was inferred that lateral compression of the eye placed it in conditions favorable to the perception of near objects; and it seemed probable that the position of the oblique muscles in the human eye best adapted them thus to modify the organ.

Myopy with Strabismus. — If the above be true, it will be readily conceived that an exaggerated contraction of the straight muscles, also compressing the ocular globe in their position as tangents to its circumference, would diminish its capacity for viewing distant objects and induce a state of myopy or near-sightedness. This theory is confirmed by the fact, which is I believe established, that the near-sightedness which accompanies strabismus disappears in a majority of cases after the operation.

Myopy without Strabismus. — Attention has been of late directed to the section of different muscles in the common form of myopy without strabismus; but the results of these experiments are wholly unsatisfactory. MM. Guerin and

[1] By Jacobson of Copenhagen.

[2] A. Bonnet, Traité des Sections Tendineuses et Musculaires, Paris, 1843, p. 207.

Cunier have reported cases of relief after section of the external and internal rectus. M. Bonnet claims similar results from the section of the inferior oblique;[1] and hence infers that a section of either of these three muscles exercises a certain influence upon the vision. He prefers the inferior oblique, as being easiest of access. In his method it is reached by plunging a short pointed tenotome through the lower lid at a point just above the centre of the edge of the bony orbit. The knife is carried backward and inward, nearly to the ethmoid, the edge being directed toward the nose. The handle is then depressed toward the outer angle of the eye, and the blade, thus brought forward, is found to have hooked up the muscle, which it subsequently divides.

DIPLOPY.

It has already been remarked that the variety of double vision which follows the operation requires only time to disappear.

When it exists before the operation, it is generally relieved by it. A dilated state of the pupil in the affected eye seems to contribute to it; and in rare cases it has been observed to accompany vision in a single eye.

KOPIOPY.

This is a name given by M. Petrequin[2] to the sensation of fatigue experienced in the use of the affected organ, either before or after operation. It seems to result from the want of power in a part rarely exercised, and subsides as the eye becomes habituated to its restored functions.

NYSTAGMUS.

Convulsive trembling of the eye is observed with or without strabismus. The ocular globe oscillates in different

[1] *Op. cit.*, p. 231. [2] Annales d'Oculistique, 1841.

directions, varying with the muscles in fault. It turns in certain cases upon its antero-posterior axis, as if moved by the main-spring of a watch attached to this axis. This motion corresponds with that which has been referred to the oblique muscles.

When the affected muscles are divided, the convulsive action ceases, but generally returns with the reunion of the parts. If we may believe M. Phillips, it is then much less marked, and diminishes until it finally disappears. Of four or five patients operated upon by M. Velpeau, none were radically cured.

STATISTICS.

Subjoined are the results of Velpeau and Phillips, as they have reported them.

Velpeau. — Three hundred cases. One half completely successful. Of the other half, one third presented a very slight deviation, exophthalmy, depression of the caruncula, fixedness of the ball, or enlargement of the lids. In the other two thirds these accidents were very manifest, and the patients retained a deformity as striking as that which existed before the operation.

Phillips. — One hundred cases. Seventy-five satisfactory results, sixteen incomplete, five not improved; in five the eye directed outwards. Of divergent strabismus, ten satisfactory, five incomplete, one not improved.

The constant success reported by Dieffenbach induced a M. Melchior to examine a number of his patients. In a Latin essay upon the subject, published at Copenhagen, he states that of forty-four patients but ten were found to be entirely relieved, and fifteen only partially so.

The results of Bonnet, Chassaigne, and Baudens are before me; but the bearing of their statistics is less obvious, as they interpret differently the term "success."

STAMMERING.

THE operation for strabismus suggested that for stammering. When it was ascertained that spasmodic contraction of the muscles of the eye was relieved by their division it was inferred that the proposition was general, and a new field was sought for its application. The characteristics of stammering were too obvious to escape notice, and hence the operations for its cure.

Dieffenbach in Germany, and soon after Velpeau and Amussat in France, announced their methods.

The results have not answered expectation, as might have been inferred from the complicated nature of the mechanism of the vocal organs. But such was not the belief of surgeons, and the tongue was carved and tied, above and below, in any way which seemed to offer a possibility of modifying its previous physiological conditions. The different operations were indiscriminately applied. It sufficed that a man stammered and the genio-glossi muscles, or the entire thickness of the tongue, were condemned to the knife.

As was natural, a few patients improved after so severe a lesion of the parts more or less concerned in the affection. Phillips states the proportion at only five per cent, an estimate which has called forth the remonstrances of more ardent advocates of the operation. Allowing for exaggeration, the method of Dieffenbach — the bisection of the root of the tongue — seems to have been followed by a certain degree of success, but is by far the severest operation.

It is evident that the machinery of articulation has not been adequately analyzed with reference to the operation, and that the indications of derangement of its various parts have been too little considered. A first step, then, towards the

study of this affection is an analysis of the articulate sounds, and of the manner of their production, of which a sketch proportioned to the limits of this essay is here offered.

The mouth, including the trachea and the lips, may be considered as divided arbitrarily by four diaphragms, necessary to articulation, and capable of intercepting both wholly or in part the air expelled by the lungs. The first of these is the vocal cords; the second, the root of the tongue; the third, the tip of the tongue; and the fourth, the lips. To these four, each by itself or aided by the nasal cavity, may be referred most, if not all, articulate sounds.

1. The vocal cords, by their vibration, produce the voice. To them is due only such articulation, if we may so call it, as is produced by their sudden relaxation, when it coincides with an expulsive effort of the lungs, — an effort termed by elocutionists exploding. They antagonize one another.

2. The root of the tongue is opposed by the soft palate, and the posterior extremity of the hard palate, as in *k*.

3. The tip of the tongue is antagonized by the front upper teeth, and by the bony palate, as *t* in *the*.

4. The lips are opposed, either one to the other, or the lower one to the upper front teeth, as in *p*, *ph*.

Sounds are modified by two conditions of each articulating isthmus; when shut, and when partially opened. Thus, with the lips, as in *p* and in *f;* with the tip, as in *t* and in *th;* with the root, as in *k* and in *ch* in the German *nicht*. The same sounds are modified by the addition of the voice thus: without the voice, as in *p;* with the voice, as in *b;* so also in *t*, *d*, *k*, and *g* hard.

A third and last alteration of the same sounds is effected by the opening of the nasal cavities, by which *b* becomes *m*, *d* becomes *n*, and *g* hard becomes *ng*.

Such are the regular principles of articulation. To these may be added three exceptional and irregular sounds, pro-

duced by the tip of the tongue against the hard palate: a whistle analogous to the whistle of the lips, as in *s*, and a little farther back, *sh;* the sound of *l*, produced by the lateral application of the tip and edge of the tongue to one side of the hard palate, while the air passes by the other side; and the vibration of the flexible extremity in the letter *r*.

This sketch may be condensed, as in the following table.

	Lips		Tip of Tongue					Root of Tongue	
	shut	partly open	shut	partly open				shut	partly open
				regular	irregular				
					hissing				
With voice	b	v [1]	d	th-ough [2]	z, j (*French*) [3]	r [4]	l [5]	g hard	
Nasal	m		n					ng	
Without voice	p	f, ph	t	th-ing	s, sh			k, q	ch in *nacht* [6]

(1) The letter *v*, though formed between the front upper teeth and the under lip, is identical with the sound produced by a slight separation of the lips, as in the Spanish *Habana*, pronounced like the English *Havana*, though formed by the lips. In the latter case it is somewhat exaggerated.

(2) Were the palate flat, it is probable the sound *th* would be produced by the position of the tongue which now forms *s*, to avoid which its extremity is advanced to the teeth.

(3) The concavity of the palate, with the similar opposing one of the tongue, produces the whistling *s* and *z*. A short distance farther back it is more diffused, and becomes the hissing *sh*, and French *j* as in *jarret*.

(4) That *r* is a vibration is shown in its exaggeration in the Italian language, thus: *giorno*, *avér* for *avére*.

(5) The sound of *l* is irregular, produced by a partial but firm interception of the current of sound by the tip and edge of the tongue applied to the palate.

(6) The *ch* in the German *nacht* is perfectly analogous to *ph* and *th* in English.

It will be seen that this table refers only to the enunciation of the consonants, which may be considered as the interruptions and interceptions of the vowels, and therefore more immediately concerned in the defect of stammering. The original sound produced by the vocal cords is modified, but not intercepted, during the production of a vowel. A complete interruption occurring after the sound has left the larynx forms a consonant.

If stammering, in its common forms, be a spasmodic contraction of the muscles concerned in the mechanism of articulation, it is probable, although direct proof is wanting, that it may exist at either of the four points already mentioned, and that each may be the seat of a variety of the affection, which it becomes important to distinguish from the rest. Some indication of the character of the affection may be drawn from that of the sounds emitted. But this is an uncertain test. An anterior portion of the mechanism, if deranged, will be liable to interfere with that behind, and *vice versa.* Thus *p* masks *t*, and *t* interferes with the articulation of *p*. When, in confirmation of these views, we witness the varying degrees of this affection, from the simple lisp to the confirmed stammer accompanied with distressing convulsions of the whole countenance, it is evident that the lesion is a complicated one, and that in its different forms it demands different methods of treatment. We cannot but wonder, nevertheless, at the temerity of surgeons, who, when a patient stammered, at once condemned him to the knife, and indiscriminately divided the genio-glossi muscles, or subjected the entire tongue to a bloody bisection, with the vague intention of modifying its nervous condition.

An adjustment of the machinery of articulation can be based only upon a thorough analysis of its complicated action. An outline of this analysis may be found in the foregoing table, and such must be the groundwork of any future efforts to identify the different forms of this affection.

The remainder of the present section will be devoted to an account of the different operations which of late years have been practised in this affection.

HISTORY.

The Paris "Journal des Débats" of January 2, 1841, contained the following original announcement of the operation of Dieffenbach:—

"We read in a German paper that a discovery by Professor Dieffenbach excites general attention at Berlin. This surgeon has found a way of curing stammering by an incision of the tongue. The operation he performs has completely succeeded. According to Dieffenbach, stammering arises from an impossibility of applying the tongue to the palate. His method consists in putting an end to this disability."

These intimations were not lost upon the French surgeons. Some of them laid claim to previous verbal suggestions of an operation. Others, adopting the principles hinted at by Dieffenbach, sought to discover his procedure; and hence resulted what is known as the French operation. It was announced nearly simultaneously by Amussat, Phillips, Baudens, and Velpeau. It subsequently appeared, however, that the surgeon of Berlin employed a different method. With the intention at once of enabling the patient to antagonize the tongue with the roof of the mouth, and of "changing the innervation," he practised a deep transverse section, sometimes with a subtraction of substance, at the root of this organ.

The French method had reference only to the liberty of the tip of the tongue, and consisted in the division of the genio-glossal muscles and other parts beneath.

The different French operations are essentially the same, and the literature of this subject relates chiefly to the operation, and is for the most part polemic in its character.

METHODS OF DIEFFENBACH.

The theories upon which Dieffenbach founded his operation are explained in the following quotations.

Shortening of the Muscular Substance. — "It is especially upon this last method [excision of a portion of the tongue] that I have founded the greatest hope, because it had for its result the shortening of the tongue, and enabled it to touch the superior wall of the buccal cavity; a movement the execution of which is especially sought. . . . The patient, after operation, has a sensation of a shortening of the tongue, and of an elevation of its point against the palate." [1]

Change of Innervation. — "As I thought that the derangement in the mechanism of language which produces stammering had a dynamic cause, and regarded it as a spasmodic state of the air tubes, situated especially in the glottis, which was communicated to the tongue, to the muscles of the face, and even to the neck, I concluded that, by interrupting the innervation in the muscular parts which participate in this abnormal state I should succeed in modifying it, or in causing its complete cessation.

"It is for this reason that the transverse section of the muscular substance of the tongue seemed to be an enterprise worthy of being attempted, and of which the success promised to be infallible, equalling in efficacy the

[1] Dieffenbach, in the Annales de la Chirurgie Française et Étrangère, Paris, 1841, tom. i. pp. 422 and 436.

transverse section of muscles in a great number of spasmodic affections."

To accomplish these ends, Dieffenbach employed successively three different methods: —

A horizontal transverse section of the root of the tongue.

A subcutaneous transverse section of the root of the tongue, preserving the mucous coat.

A horizontal section of the root of the tongue in its entire breadth and thickness, with excision of a triangular piece.[1]

Method of Excision. — The patient is seated, his head supported against the chest of an assistant. The tongue is protruded and seized upon its edge by the teeth of a *pince de Museux.* Thus laterally compressed it gains in thickness, a condition favorable to the operation. Being then carried forward and a little to the right, by one aid, while another draws apart the angles of the mouth with blunt hooks, the root is seized by the thumb and forefinger of the operator's left hand, laterally compressed, and raised. The blade of a bistoury, edge upward, is entered at the left side of the root, penetrates to the opposite surface, and cuts its way out from below upward. The posterior edge of the wound being fixed by a stout ligature, the anterior border is seized with toothed forceps, laterally compressed, and cut off with a narrow bistoury. The piece thus removed is wedge-shaped, the base about three fourths of an inch in breadth, corresponding to the mucous surface, and has been compared to a slice of melon. The posterior edge is then brought forward, by means of the ligature and a small hook, and united to the anterior edge by six strong points of suture, which, traversing the bottom of the wound, impede hemorrhage.

In subsequently removing the first ligature, if it be followed by an oozing of blood, it is an announcement that the cicatrization is not yet solid, and the surgeon should desist. This

[1] Lettre à l'Académie Royale des Sciences, printed at Berlin.

fact, and the manner of arresting the hemorrhage by deep sutures embracing the mass of the tongue, may serve as hints for other operations upon these parts.

The Simple Section of the Root of the Tongue resembles the preceding method, without the removal of the wedge-shaped mass.

Subcutaneous Section of the Root of the Tongue. — In this operation, the upward section terminates before dividing the mucous coat upon the superior surface of the tongue.

Dieffenbach thus speaks of the dangers of the operation: "The loss of the tongue by gangrene or by extensive suppuration, or even by a lack of dexterity of the assistant, who may easily tear it, are considerations which require to be maturely weighed, and which, joined to the difficulties which it presents, will hinder operators of little experience from wishing to attempt it."

FRENCH OPERATION.

The propositions of the French surgeons embraced the principal points presented by Dieffenbach. The conditions supposed to accompany stammering, indiscriminately in all its varieties, are thus enumerated: —

Slight deviation of the tongue to the right or left.

Impossibility of pressing the tip of the tongue against the upper lip without the aid of the lower jaw, which advances to support it.

Spasmodic agitation of the tongue during the act of phonation.

To these Velpeau, Amussat, and others added a fourth proposition: —

A remarkable development of the genio-glossal muscles, the frenum being strong and hard.

The division of these muscles is the aim of the French operation. The different methods are subjoined.

Method of Phillips. — The patient is seated, as in the operation of Dieffenbach. The surgeon seizes the frenum at its angle of reflection upon the tongue with a hook, bent at right angles that it may not impede his subsequent manipulations, and confides it to an aid. He then implants a second small hook in the frenum, at a half-line distance from the ducts of Wharton, and between the two hooks divides largely the mucous coat, with scissors. Laying aside the scissors, he introduces by the wound a blunt hook edged upon its concavity, and, collecting upon it "all the muscular mass of the tongue," divides it with a sweep of the instrument.

Phillips, it is seen, severs the muscle near its fan-like expansion in the tongue. The other methods deal with a point nearer the jaw, where the muscle is less voluminous and less vascular.

Methods of Velpeau.—The tongue is held by the left hand, armed with a linen cloth, and drawn aside. A puncture is made with a lancet at the right of the frenum near the under jaw. A tenotome is plunged in the aperture to the depth of three fourths of an inch, and the genio-glossal muscles are divided without enlarging the incision of the mucous membrane.

In another case the section was made with scissors.

In a third patient M. Velpeau removed a triangular mass from the point of the tongue, and the wound was brought together by sutures.

In a fourth, the anterior pillar of the velum palati, which contains the palato-glossus muscle, was divided, but without success.

At a subsequent operation this surgeon strangulated by ligature a mass resembling in size and position the wedge removed in the operation of Dieffenbach. The tongue, being drawn forward, was traversed at its root by a needle armed for strength with four threads. Two were tied over the back

of the tongue. The two others were tied in the same way, a little in advance of the first, thus insulating a portion of the tissues which subsequently sloughed away.

Method of Amussat. — The surgeon first divides the frenum with the mucous membrane on each side, and the salivary glands, avoiding the ducts of Wharton. If no advantage is gained, the genio-glossal muscles are divided near the apophyses. If during this process the tongue be thrust forward and upward, the muscles spontaneously offer themselves for section, and are easily divided with knife or scissors.

Method of Baudens. — This surgeon employs pointed scissors bent at an elbow near the pivot, like Roux's scissors for the operation of staphyloraphy. Slightly opened, they are thrust to some depth astride the genio-glossal muscles, which are then divided at a single stroke. The genio-hyoid muscles are sometimes included in the section.

Method of Lucas, of London. — The mucous membrane and cellular tissue are dissected to the extent of an inch, for the purpose of exposing and avoiding the ranine arteries, the large veins, and a branch of the lingual nerve which borders the outside of each muscle. The muscles are then divided, and a triangular fragment, whose base corresponds to the surface, is detached.

Subcutaneous Operation. — M. Bonnet has proposed a puncture beneath the chin, at the distance of an inch behind it. A tenotome is introduced, and thrust upward, its edge toward the bone. When it is perceived beneath the mucous membrane the surgeon feels for the insertion of the genio-glossal muscles and cuts to the right and left. By keeping the edge of the tenotome against the jaw and acting only upon the superior part of the convexity of the bone, upon a median line, the insertions of the genio-hyoid muscles are avoided.

ACCIDENTS AFTER THE OPERATION.

Hemorrhage. — The vascularity of the parts, the size of the incision, and the difficulty of commanding the bleeding vessels, are conditions which give rise to formidable hemorrhage, arrested with difficulty by means more painful than those employed to remedy the stammering. It is obviously difficult to gather evidence upon this point. At a time when surgeons emulated each other in reporting successful results from the operation, various motives induced misrepresentation. But the danger of hemorrhage is not altogether concealed. Dieffenbach says of his own subcutaneous method, "The blood gushed with abundance from the two lateral wounds, as if it escaped from a large arterial trunk, and the tongue soon became tumefied by the mass of blood which accumulated in the interval of the subcutaneous section." The books allude to a student at Berlin operated upon by this surgeon, who died from the profuse bleeding attendant upon the operation.

Phillips says of the operation, "It is surrounded with too many dangers to be retained in practice. The hemorrhage is always very abundant, and we possess no means to arrest it, unless by a second operation, more painful and more cruel than the first." And in another place, "The hemorrhage which follows this operation is of long duration; and I felt the greatest anxiety after having operated upon a young man of Liège. The section of the muscles was made at eleven o'clock in the morning. At eight o'clock in the evening the blood still flowed, as from the mouth of an open artery." Again, "I have seen patients in my practice lose blood seven or eight hours after the operation, without the possibility of arresting it."

M. Guersent, surgeon of the Hôpital des Enfants, has published a remarkable case of this kind, in which the patient,

a child of twelve years, was predisposed to hemorrhage. After the operation by Amussat's method, the hemorrhage commenced, and was renewed at intervals for ten days. During this time every means were employed to arrest the bleeding, — styptics, balls of charpie, cold lotions, and finally the actual cautery, which was renewed seven times. At the end of ten days the patient presented a state of almost complete anæmia, from which it slowly recovered. At the end of three weeks *the child stammered as before*, the tongue being much shorter after the operation.

The bleeding is promoted by the inclination which patients have to suck blood from the wound.

The hemorrhage should, in common cases, be treated by the injection of iced water, *tamponnement*, or plugging with balls of lint wet with alum or some other styptic solution. In the operation of Dieffenbach, the bleeding is counteracted by deep sutures, which are drawn tight, thus compressing the mass of the tongue. The hemorrhage is usually arrested by the formation of a more or less voluminous clot, which should not be disturbed. Phillips alludes to two cases of obstinate hemorrhage following the removal of the coagulum.

Tumefaction of the Tongue. — The engorgement of the tissues, often considerable during the inflammatory action, is sometimes such as to hazard the life of the patient.

"Everybody knows the deplorable story of a young man operated upon, whose tongue acquired a considerable volume. It formed upon the lower wall of the mouth a vast *valve*. During the night, the symptoms became more and more alarming, and the result was finally enveloped in a profound mystery. How many other examples have had the same fate!" [1]

In the "Gazette des Hôpitaux" (Juin 1, 1841) M. Amussat has avowed one case of death. The subject had been operated

[1] Phillips, Ténotomie Souscutanée, p. 392.

upon in presence of a commission named by the Academy. The same journal contains also the history of a man who came near dying of asphyxia by the enlargement of the tongue.

The tongue, left to itself after the section of the genio-glossal muscles, exercises a great force of retraction, and has a tendency to turn back upon the glottis, an accident which it has been shown may be fatal. A similar accident is to be apprehended from the posterior portion of the tongue in the transverse dorsal incision of Dieffenbach, and hence the care requisite to secure it during the operation by means of a ligature or a hook passed through its substance.

APPRECIATION OF THE DIFFERENT METHODS.

In estimating the comparative value of the different methods, a first ground of comparison, unquestionably the most important, is their efficiency in relieving the imperfection of articulation. The inadequacy of the operation in a majority of cases seems generally to be conceded. It has been shown that, by its application to a part only of the articulating machinery, it is theoretically incomplete. But such an admission is not to be looked for in papers upon this subject, the aim of most of which is to herald the success of a new operation, and to give notoriety to its advocates.

To this remark there are exceptions. Dieffenbach considers the operation inapplicable in certain cases, and also concedes that "the indications" of the operation are much more difficult to determine than in the operation for strabismus.

Of the French operation Phillips thus speaks: "Among true stammerers there are some who redouble the *b*, *p*, *d*, *t*, and who pronounce for example *b*, *b*, *b*, *b*, *a*, etc. These may be improved by the section of the genio-glossi, but not radically cured; the lips play a too considerable rôle in

the articulation of these letters. Those who redouble the *t* and the *a* may be radically cured by the section of the genio-glossi, if there is not at the same time some defect in the respiration. Stammering upon *s* and *z* may be also diminished by the operation; but if it bears upon the *h*, *k*, and *m*, the operation is without effect. I have never, up to the present day, been able to appreciate the least change upon these letters after the operation."

These observations are cited as confirming the analysis of sounds laid down by the writer in the beginning of this section.

The articulation of the consonants mentioned by Phillips, as affected by the section of the genio-glossi, will be found referred in that table to the tip of the tongue, and consequently directly influenced by the liberty of that part of the organ.

M. Chassaigne,[1] another writer upon this subject, in opposing this theory of Phillips, cites a case in which the pronunciation of the sentence *Maman m'a mandé* was facilitated by the section of the genio-glossi. It is probable that in this case the affection existed, not in the labial muscles, but in those of the tip of the tongue, the spasmodic action of which masked or impeded the labial articulation. Such mistakes have arisen from an insufficient study of the varieties of the affection. In most reported cases, it sufficed that the patient was unable to articulate certain test words, like those alluded to, or "Kakoski, Colonel des Cossaques," "hippopotamus," "concupiscence," and he became a subject for the operation, according to the method then in vogue. If after this lesion of the buccal cavity the spasmodic action of the muscles ceased for a time, the operation was proclaimed satisfactory in its result. Such has been the assertion after operations I have often witnessed in the Paris hospitals, and in the majority of printed observations.

[1] Traité du Strabisme et du Bégaiement, Paris, 1841, p. 140.

Authors seem to accord to Dieffenbach a greater share of success than to other surgeons. No means of estimating the value of his assertions upon this point are at hand. It is however difficult to give full credit to statements like the following: "I have within a short time operated upon fourteen stammerers by removing a triangular piece of the tongue, and in all the stammering has entirely ceased."[1] It may be suspected that at the end of a longer period it returned, at least in some of the cases.

It is easy to imagine that, in promiscuous operations upon the different varieties of the affection, the section of Dieffenbach, which involves all the lingual muscles, should more readily alter the functional conditions of the tongue than the division of the genio-glossi alone. But if the division of muscles be its object, this method attacks indiscriminately the interweaving fibres of all the fasciculi, without bearing directly upon the body of any one of them. On the other hand, it is difficult to establish how far it may alter the innervation of the tongue; neither is this proved to be the essential end of the operation. If the previous length of the lingual surface interfered with the power of opposing the tip to the palate, the removal of a portion of the dorsum might tend to obviate this difficulty; but much less directly than the division of the genio-glossal muscles.

Until the applicability of the German operation be clearly indicated, and its efficacy shown, the profuse and dangerous hemorrhage, the tumefaction, and other inflammatory accidents to which it is liable, are insurmountable objections to its performance.

The same is true in a less degree of the French method, which, however, probably applies to a greater number of cases, and is least objectionable when the point of section approaches the jaw bone, as in the subcutaneous section of

[1] Dieffenbach, Gazette des Hôpitaux, 18 Mars, 1841.

Bonnet, which is confined to the tendinous insertions of the muscles. The analogy of this method to the simple section of the frenum in tongue-tied children is obvious. It is sometimes employed with advantage where the tongue is not confined, but where the spasmodic condition of the genio-glossi muscles can be clearly demonstrated.

The method of Velpeau, by ligature, offers a smaller chance of hemorrhage, but is even more subject to violent inflammatory accidents. The removal of a triangular mass from the anterior part of the tongue and from the genio-glossal muscle, the division of the genio-hyoid, and other equally fanciful sections, are evidently experimental.

Authentic statistics in regard to these different operations will not be expected when the unscientific character of most of the papers upon this subject is considered. The following figures, those of Dieffenbach excepted, refer to the French method.

M. Baudens says, "We count at this time twenty-one persons operated upon by our method. All have obtained, if not an absolute cure, a notable amelioration." It is sufficient to add, that in regard to strabismus the same author remarks, "In eight hundred squints that we have operated upon . . . we have succeeded in every instance: let sceptics put us to the test: let them give us the most desperate cases, and when we have failed once, we will yield to the evidence." Such assertions need no comment.

Dieffenbach has just been quoted as having operated upon fourteen patients, in all of whom the stammering had entirely ceased.

Chassaigne, of seventeen cases, gives seven cured, five ameliorated, and five with no beneficial result.

Finally, Phillips concludes his essay as follows: —

"Of one hundred individuals speaking badly, and improperly called stammerers, we find only five subjects who

really stammer, and who can be operated upon with success. Of these five individuals, three stammer only upon the lingual letters. In such cases the operation is striking in its results; the stammering ceases entirely. The other two stammer upon linguals and labials, and then the operation affects the stammering of the linguals alone and hardly modifies that of the labials.

"I have seen in the service of M. Velpeau a case of brilliant success after an operation upon a subject who stammered, i. e. redoubled the linguals.

"The ninety-five other individuals do not stammer, but speak defectively; either because they shut the mouth in trying to talk, or because they do not breathe, or because they cannot or do not know how to make use of the tongue to aid articulation, or finally because they have nothing to say."

TENOTOMY.

The division of tendons is an operation of ancient date. Tulpius, in 1685, refers to Isacius Minius as having practised it. It was at that time considered a grave and dangerous procedure, and De la Sourdière, in 1742, concludes a memoir in the following words: "The section of tendons ought then to be avoided." In 1782 or 1784 Lorenz divided the tendo Achillis at the request of Thilenius, a physician of Frankfort; and Michaelis soon after effected, though incompletely, the same section.

Until recently, it was the custom of surgeons to incise the integuments with the tendon, the severed extremities of which were freely exposed to the air. In these conditions, the divided tendinous surfaces remain for a length of time pale. Slowly they become vascular, granulate until the vegetations fill the surrounding void, and finally heal, with

a dense firm cicatrix, which involves cellular tissue, aponeuroses, and integuments. The sliding of the tendon is thus impeded, and in its restricted movement it carries with it the surrounding and adhering tissues. The restorative process is in such circumstances tedious, and the constitutional reaction and consequent hazard to the patient considerable.

At the present day, the division of tendons is a trifling operation, and almost devoid of danger.

Delpech first proposed a section which should not denude the tendon. A bistoury was passed beneath the skin, which it traversed at two points, as if for the passage of a seton. The incision was extended to the length of about an inch, and the tendon was divided.

Stromeyer, and before him Dupuytren, according to Velpeau, indicated the method by simple punctures. The latter surgeon confined himself to a single orifice, which gave admission to the instrument, taking care not to wound the integument of the opposite surface. This is essentially the method of the present time, and the most simple which science now possesses. It has undergone two modifications, referred respectively to Stoess and Bouvier.

In the method of Stoess, the knife is introduced beneath the tendon, which is divided from within outward. Bouvier enters the instrument beneath the skin, and divides the tendon from the surface toward the deep-seated parts.

The field of *subcutaneous operations*, effected by a simple puncture of the integuments, and applied to muscles and aponeuroses as well as tendons, has been widely extended by various surgeons, among whom Dieffenbach and Guerin are conspicuous. The exclusion of air is the aim and characteristic of this method. A degree of vitality is thus retained in the injured parts, and even in the effused blood, which favors in a remarkable manner their reparative action. The functions of absorption and secretion are carried on with

a rapidity to which the presence of the atmospheric air seems fatal.

An entirely new class of operations by this method has sprung into existence, to which the continuation of this essay will be devoted.

SUBCUTANEOUS CICATRIZATION OF DIVIDED TENDONS.

It is well known that a tendon, when divided beneath the skin, is disposed to retract, leaving an interval between its extremities at the point of section. In most cases the interval is obliterated, and the continuity of the tendon re-established by the gradual deposition of an intermediate fibrous tissue. Observers differ with regard to the manner in which this tissue is formed, and experiments have led to apparently contradictory results.

Stromeyer, in attributing the deformity of certain club-feet to muscular contraction, asserts that the length of the newly formed tendon, which he compares to a thick ring, is alone insufficient to account for the rectification of the deformity; and supposes that the muscle, once relieved from the stimulus of tension, elongates itself until the divided tendinous surfaces are brought into contact. On the other hand, it may be urged that the interposed mass is often considerable. In one experiment of Bouvier its length was nearly two inches at the end of twenty-four days. It is possible that the tendinous end, enlarged at its point of union with the newly deposited matter, may have been mistaken by this surgeon for the entire substance of the cicatrix.

One class of observers, among whom are Held and Bouvier, suppose that the tendinous sheath, with its surrounding cellular tissue, undergoes a gradual transformation into fibrous matter, with agglutination of its walls and obliteration of its cavity. Others, leaning to the theory of Hunter, assert that the cavity of the sheath is a receptacle of blood and of lymph,

which is afterwards organized and converted into tendinous fibre. Such are Ammon, Guerin, Phillips, and Duval.

The results of the detailed experiments of Bouvier[1] on one side, and Ammon[2] on the other, render it probable that the restorative action varies in different circumstances, and accommodates itself to the pathological conditions of the parts. In the experiments of Ammon the effusion of blood was constant, and was probably due to a laceration, more or less extended, of the fibrous envelope and surrounding cellular tissue. Hemorrhage was of rare occurrence in the cases of Bouvier; and we infer that care was taken to divide the tendon without injury to the neighboring parts. Whether with Guerin we consider the effused coagulum to be a condition essential to the process of restoration, or with Velpeau regard it as an accidental complication, it is evident that such a body of fibrine, interposed between the divided tissues, must modify the process which nature sets up where no such extraneous matter exists.

The experiments alluded to seem to establish the following propositions.

When the tendinous sheath is little injured, and there is a free communication between the divided ends of the tendon, the tissue of the sheath becomes dense and indurated by the deposition of fibrous matter, and layers of cellular tissue are successively impacted upon its exterior. In the mean time its cylindrical cavity, strangulated at the centre, gradually contracts; lymph is exuded in its interior; the extremities of the tendon assume a conical form, and, uniting with the sheath, the whole mass finally acquires the character of a dense fibrous cord.

But when the surrounding tissues are divided, and a coagulum is deposited in the wound, — when, instead of the fibrous

[1] Mémoires de l'Académie Royale de Médecine, tom. vii.
[2] Expériments, tom. i. p. 155.

sheath ready at hand to be converted into tendon, a foreign body, as it were, is interposed between the divided surfaces, — the process of restoration is different. While the wounded surfaces exude lymph, the coagulum plays the chief part in the formation of the new tendon. It becomes gradually organized. Its substance is penetrated by vessels, which in their turn deposit plastic matter, until the severed extremities are at length united by a few filaments. These increase in size, acquire a compact texture, and are fused in time into a fibrous resisting mass.

GENERAL CHARACTERS OF DEFORMITY.

It is probable that all congenital distortions of the trunk and limbs are the result of muscular contraction, originally induced by an affection of the nervous centre or its branches. At the period when the surgeon is called upon to operate it is no longer active, and he deals only with results, as presented by certain modifications of the muscles, fibrous tissues, and vessels.

The original affection, being a spasmodic action of the muscular fibre, has received from Guerin the name of "contraction"; while the consequent and permanent lesion, as exhibited in the partial or entire change of the muscular into a fibrous tissue, has been called by the same writer "retraction."[1] The duration of the state of simple contraction is indefinite; and during this period the soft parts may be elongated by proper means. But the fibrous change is attended with rigidity, unyielding in proportion to the extent of the transformation.

Most cases of club-foot present these characters, and date either from fœtal existence, or from some convulsive affection of early life. Their leading and distinctive feature is a tense-

[1] To this condition Little has applied the term "structural shortening." Lancet, December 9, 1843, p. 39.

ness of certain tendons, which become especially evident beneath the integuments when an attempt is made to correct the deviation. They are then rigid and salient, and manifestly interfere with the normal position of the limb.

Retracted muscles are generally found upon dissection to be pale, atrophied, and partially converted into fibrous tissue. They are more or less completely paralyzed, and their development has been arrested. The fatty transformation is more rare, and of less importance to the surgeon. It has been doubted whether it be possible to detect this lesion through the integuments. When it interferes with the restoration of the limb to a normal position, it is generally more or less combined with the fibrous change.

Guerin has laid down two rules with regard to the change which the muscles undergo when thus permanently contracted.

In all chronic deformities the muscles, instead of continuing their primitive relations with the distorted portion of the skeleton, tend to become shorter and to assume a straight line between their two points of insertion.

The transformation of muscles is fatty or fibrous; fatty, when the muscles are compressed and left to themselves; fibrous, when they are submitted to exaggerated traction.[1]

The tendons and ligaments seem arrested in their development rather than changed in form. In a state of repose the fibrous cords become more compact, and are not unfrequently converted into bony matter. Guerin supposes that this osseous deposition only occurs when the muscles become fatty; but the position has been disputed by other surgeons.

The arteries do not follow the muscles in their deviation. They are neither shortened nor tense and straight. "They accompany the muscular curves when they are attached to these muscles, and become tortuous when free; the more so when the distance they traverse is limited."[2]

[1] Vues Générales, etc., Paris, 1840, p. 23.

[2] *Op. cit.*, p. 25.

The nerves tend to diminish in length and to adapt themselves, like the muscles, to the chord of the curve produced by the deformity. This disposition to retract is attributed by Guerin to the fibrous tissue of the neurilemma.

The veins dilate and increase in number, — modifications supposed by Guerin to explain the fatty transformations of the tissues in general. The tendency of the skeletons of deformed limbs to exude a greasy matter is well known.

INSTRUMENTS AND MANUAL OF THE OPERATION.

The *instruments* contrived for subcutaneous operations are exceedingly numerous, and the more important ones will be mentioned in another place. Many of them offer useless complications and refinements. The sections may all be effected with one or two tenotomes. The most useful consists of a blade about an inch in length by one eighth of an inch wide, pointed, and slightly convex. Attached to a short cylindrical shank, it serves to divide the larger tendons. Probe-pointed, straight on its edge, and with a longer shank, it may be used for the broad or deeper-seated fibrous tissues. (Figs. 8, 9.)

The tension of tendons is by far the most important indication for their division. When it is ascertained that their retraction interferes with the normal position of the part, it is expedient, as a general rule, to divide them; beginning with the most rigid and salient.

The manual of the operation is briefly as follows. The region being placed in a convenient position, the tendon to be divided is made tense, and if possible evident beneath the integuments. This is effected either by the position of the patient, by voluntary contraction of the muscle, or by external force properly directed.

Guerin pinches up, immediately over the tendon, a fold of skin, one end of which is confided to an aid, and introduces the tenotome flatwise at its base. He then releases the in-

teguments, and the puncture recedes to a distance from the point of section while the blade retains its position near the tendon. The tendon is now made tense by active or passive flexion or extension and divided by a slight sawing movement of the knife.

It is unimportant whether the section be made from without, or from within the tendon, if there be no especial indication, such as the neighborhood of large vessels, to guide the operator. A place of section should be chosen where the tendon is surrounded by cellular membrane. It is rarely possible to obtain union in the cavity of a synovial sheath; and permanent deformity has resulted from division of the tendon in this position.

At the moment the section is completed a noise is heard as the two ends suddenly recede from each other, which is modified and exaggerated if it be near the region of the thorax. The instrument is withdrawn as it was entered, the integuments being compressed, as the knife recedes, to hinder the admission of air. As the blade leaves the puncture the finger arrives at and covers it, until it is effectually sealed by a bit of adhesive plaster.

HEMORRHAGE.

If the hemorrhage be considerable a tumor forms at the seat of the effusion, and the blood should be expelled through the puncture as far as practicable. It is most frequently distributed in the cellular membrane, and left for subsequent absorption. Alarming hemorrhage is rare, as the larger vessels are not involved in the operation.

In some experiments of M. Amussat which I saw at the Abattoir Montmartre, the open vessel, even when of considerable size, if completely divided, occupied the centre of a coagulum, the substance of which acquired such tenacity as to confine the fluid nucleus, and arrest the effu-

sion.[1] In deep sections additional security is offered by the flexibility of the vessels, which yield before the edge of the knife while the resisting tendon is divided. Hence it is better in such positions to avoid as far as possible the sawing movement of the instrument, and to divide the tendon by pressure perpendicularly applied.

MECHANICAL TREATMENT.

It is now generally allowed that an immediate application of mechanical force is not indicated. Inflammation, re-opening of the puncture, admission of air and suppuration, were not unfrequently the sequence of the operation in past years. These accidents have become less common since attention has been directed to the cicatrization of the integuments before beginning the mechanical treatment.

The principle of the various machines contrived for this purpose is simple. Their object is to direct and maintain a permanent counteraction against the curve of the deformity. A separate part of the apparatus is adjusted to each detached portion of the skeleton, while the centres of movement of the machine correspond to the articulations, and are fixed by ordinary mechanical expedients, such as a ratchet wheel, rack and pinion, or best by a perpetual screw. (Figs. 16, 17, 18.)

Of mechanical treatment without division of the tendon, little need be said. It is often efficient in infancy, and in certain cases of spasmodic or slight deviation. But in a common case of chronic deformity two elements oppose the return of the parts to a normal condition, the distortion of the bone, and the tension of the unyielding fibrous tissue which approximates its extremities. In severing these tense fibres, we remove one of the chief impediments to the restoration of

[1] These results have been since generalized by further observations upon hemorrhage in the human subject. Amussat, Communication à l'Académie des Sciences, October 28, 1844.

the part, as becomes evident from the sudden separation of their divided extremities. It has been abundantly proved that, under proper restrictions, the operation is a safe one, and that, while the duration of treatment is abridged, there is less chance of a return of the deformity than when unaided mechanical treatment is adopted.

CLUB-FOOT.

Certain rare cases of this distortion result from idiopathic malformation, or other lesion of the bony tissues; but by far the most numerous class is due to muscular agency.

Club-foot has been defined to be the result "of inequality in the antagonizing muscular forces, and of the permanent retraction of certain muscles." [1]

CAUSES.

Its causes may be considered under two heads, congenital and consecutive, with reference to the period of their influence.

Congenital. — Among the probable influences supposed to act during the fœtal state are the following: —

An intrinsic muscular contraction, due to the agency of the cerebro-spinal system. As the most frequent cause of club-foot, this is by far the most important to the surgeon. It occasions a large majority of the cases with which he is called upon to deal.

The mechanical pressure of the uterine fibres, or the bad position of the child *in utero.*

The first of these two varieties has been investigated by Guerin, who considers convulsive muscular contraction as an essential cause of the congenital form of distortion. His

[1] Traité Pratique du Pied-bot, par Vincent Duval, Paris, 1843.

theory is founded upon dissections of fœtal monstrosities and deformities, where lesion of the nervous centre or of its ramifications was evident, and upon the fact that convulsive action often accompanies strabismus and other deformity in various parts of the system.

In confirmation of this position he offers, with other evidence, the following remarkable observation. Twin infants were affected with double congenital club-feet, which at the end of six months had assumed a natural contour, under treatment. At this time one of the infants was seized with convulsions, accompanied with a return of the club-feet, which were treated anew with success. At the end of a year fresh convulsions occurred, and the distortion was again reproduced in one of the feet, though in a less degree.[1]

An unequal pressure of the uterus has been assigned as a cause of fœtal distortion; but this explanation admits of doubt. The presence of the water of the amnios would tend to counteract such pressure, and upon this ground Breschet rejects the theory, while Guerin, on the other hand, maintains that a certain lateral, but uniform, flattening of the foot may result from this cause. Duval offers a number of observations tending to show that certain positions of the child during uterine life may induce deformity. In these instances the club-foot was accompanied by distortions which were evidently exaggerations of the natural position; such as a permanent folding of the arms, the thighs being flexed upon the pelvis. They seem rather to indicate a general tendency to muscular contraction than a distinct cause of the development of club-foot.

Guerin discards the doctrine of an arrest of development, advanced by Breschet, as an original cause of distortion, but admits the influence of this principle as a consequence and aid of muscular retraction.

[1] Étiologie Générale des Pieds-bots Congénitaux, 1843.

Consecutive. — These sources of distortion are more readily appreciated. Among them are wounds of the leg or plantar surface, blows, and sprains. That variety which results from wounds, or from disease of the bones, generally bears marks of the lesion which has provoked the deformity; and cicatrices and contractions of the integuments supply the place of the distinctive marks of retraction.

It is generally allowed that the paralysis of certain muscles may produce distortion, by permitting the unopposed contraction of the antagonizing muscular forces. The subsequent transformation of these muscles then permanently confines the limb in its new position. The majority of operators advocate tenotomy in such cases, if the distortion materially interferes with the convenience or comfort of the patient. The deviation once corrected, the traction of the healthy muscles may be counteracted, and the normal position maintained by springs or other mechanical contrivances. In this way the condition of the patient is often very considerably improved.

Both in the congenital form and in chronic cases which result from spasmodic action, occurring at a period subsequent to birth, we meet with the conditions of retraction before described. The muscular fibre has given place to a more or less fibrous tissue. It has become pale and atrophied; its development has been arrested, and the points of its insertion are approximated. Beneath the integuments are found a series of tense, salient cords corresponding in position with the tendons, and especially evident when an effort is made to restore the foot to a normal position.

VARIETIES.

Most authors recognize three varieties of club-foot; viz. *Equinus*, *Varus*, and *Valgus*.

Equinus. — When the heel is drawn towards the calf, and

the patient walks upon the toes or metatarsal extremities, like the horse, which gives a name to the distortion.

Varus. — When the plantar surface is turned inward, and the limb rests upon the outer edge of the foot.

Valgus. — When the sole is directed outward.

To these are added a rare variety called *Talus.* Here the toes are drawn upward, upon the front of the leg, while the heel alone remains upon the floor. It is directly opposed to *Equinus.*

Modern writers have proposed other divisions.

Duval proposes the general term *strephopodie* (*στρέφω, ποῦς*) for deviation of the foot, and varies its application by the insertion of the prefixes *ἔνδον, ἔξω, ὑπό, ἄνω, κάτω*, thus: streph-endopodie, -exopodie, -hypopodie, -anopodie, -ocatopodie, for deviation inward, outward, under, upward, and downward.

The division of Bonnet is more worthy of attention. He divides club-foot into two classes:[1] —

Those forms produced by the retraction of muscles supplied by the external popliteal nerve.

Those produced by the retraction of muscles to which the internal popliteal nerve is distributed. Thus the internal popliteal club-foot includes the varieties Equinus and Varus; while the external, much less frequent, consists of the different degrees of Valgus and Talus.

The amount of distortion is marked by degrees. Thus Dieffenbach divides each of the three ordinary varieties into five degrees; Phillips and Guerin each into three. Bonnet subdivides his two varieties each into five degrees.

I adopt the most familiar classification, and shall describe three degrees of each form of the affection.

[1] Sections Tendineuses, 1841, p. 432.

EQUINUS.

The first degree of equinus consists of a direct elevation of the heel from the floor, due to the action of the gastrocnemius. In the second, this action is exaggerated, and often complicated by that of other muscles. In the third, the toes are bent backwards under the foot, and the bony framework is more or less distorted.

First Degree. — The subject walks upon the extremity of the affected foot, of which the toes are more or less extended towards a right angle. The calcaneum is carried upward, and the astragalus slightly dislocated forward. The retracted muscles are those attached to the tendo Achillis, and occasionally the extensor of the great toe. The foot is slightly arched, and shorter than its fellow. It presents upon its plantar surface two callosities, corresponding respectively to the heel and ball of the foot, the latter being well developed. The toes are elevated, partly by the weight of the body, and partly by the contraction of their tendons.

Second Degree. — The mode of walking is an exaggeration of the last; the foot often inclining to one or the other side when the muscular tension is unequal. The skeleton presents a similar position of the calcaneum and astragalus, the former of which sometimes touches the tibia, while the extension of the toes throws the weight of the body upon the articulating extremities of the metatarsals.

Besides the retracted muscles of the calf, the extensors and in some cases the flexors of the toes begin to appear beneath the integuments. The foot is shorter and broader, the heel and toe being drawn together, as Guerin supposes, by the retracted fibres of both surfaces. Hence also its arched form. The great toe is occasionally raised by its own retracted tendon, while the other toes are sometimes flexed upon themselves in their position of extension. The skin of

the plantar surface is wrinkled, and presents a rough callus at the metatarsal extremities. That of the heel, if it no longer touches the ground, becomes smooth and delicate.

Third Degree.—As the contraction increases, the extremity of the foot gradually passes beyond the perpendicular. The toes are directed backward, until the dorsal surface is beneath and plays the part of the sole. At this degree it is rarely uncomplicated with one of the other varieties. The bones yield to the forcible retraction of the muscles and to the superincumbent weight. The metatarsals are curved backwards and slightly separated from the cuneiform bones. The ligamentous articulations of the tarsus become lax, and the astragalus is almost entirely dislocated.

The gastrocnemius, the flexors and extensors of the toes, and the plantar aponeurosis, are concerned in this degree of equinus. Lateral complications involve other muscles. The foot has become greatly distorted. The skin of the sole is thin, while that of the inverted upper surface has become hard and rugous. Flexion and extension are precluded, and the arched instep exhibits in its cavity the salient and retracted fibres. The toes are often interlaced, the calf much reduced in size, and the knee somewhat flexed.

VARUS.

The turning inward of the foot is characteristic of this complex form.

In the first degree the inner edge of the foot is raised from the ground. In the second, the patient walks upon the outer edge, while in the third the sole is directed upward, and the dorsum fulfils the functions of a plantar surface.

In simple varus the foot is raised upon its external edge, while the sole, looking inward, is directed forward and backward. It is rare. Guerin observed but seven cases in four

hundred club-feet; or less than two in one hundred.[1] It is more frequently complicated with equinus; which has led the same author to make the divisions of *varus*, *varus equinus*, and *equinus varus*, as the one or the other gradation predominates; each of the last two being subdivided into three degrees. The inward inclination of the foot is sometimes due to the unaided action of the gastrocnemius, but more commonly results from the traction of other muscles.

The distortion of the skeleton may be resolved into two elements; adduction and extension.

Adduction. — The astragalus forms a centre for the movements of the calcaneum and scaphoid bones. The cuboid moves upon the calcaneum, the cuneiform upon the scaphoid, while the toes follow the cuneiform in their progress inward. The calcaneum presents its inferior face to the opposite foot, but its attachments to the astragalus undergo little modification. The cuboid is carried inward with the scaphoid, and exposes a small portion of the surface by which it is articulated with the calcaneum. The scaphoid undergoes a more considerable displacement. It is even partially dislocated. Passing inside the head of the astragalus, and descending from its upper part, its position is oblique. The head of the astragalus, at its external and upper part, is salient beneath the integuments, while a new articulation is formed upon its internal surface.

Extension. — The trochlea glides through its socket, and is exposed in front of the tibia and fibula. A number of new articulations result from this forced extension. The scaphoid, at its superior internal part, comes in contact with the internal malleolus. Behind, the tibia, and finally the fibula, are articulated to the calcaneum. The displaced articular surfaces become gradually ossified. The head of the

[1] Mémoire sur les Difformités du Corps Humain, Paris, 1843, p. 320.

astragalus is depressed internally, and the anterior facet of the calcaneum, absorbed upon its internal surface, becomes oblique.

The walk, in varus, is difficult. In the exaggerated form, the patient often requires a crutch or cane. The skin of the dorsal surface, before it acquires a power of resistance, often takes on inflammatory action at its point of contact with the ground. The knees are inclined inward, and the affected foot swings over its fellow, or describes curves to avoid it. The muscular action is complicated. The elevation of the heel is due to the muscles of the calf. The chief agents of adduction are the tibiales posticus and anticus. As the foot deviates inward, the tendo Achillis begins to act in the chord of the arc described by the leg and heel, and exerts an important influence in adduction. The flexor of the great toe now begins to draw, and the foot, yielding to the combined action of this muscle and the flexors of the sole, curves upon itself. In other cases the common flexor of the toes and the adductor of the great toe are retracted, and both the flexors and extensors of the foot, acting as adductors from the change in the direction of their insertions, promote the distortion. The curve of the foot is aided, in this position, by the retraction of its dorsal muscles and the plantar aponeurosis, while the tension of the long peroneal compresses it laterally.

In its later stages this variety yields with difficulty to surgical treatment. The relations of the bones are much altered, and the shape of the foot is sometimes little modified after section of the tendons. In cases of extreme distortion, the foot resembles a huge fist. The toes are flexed and interlaced, and the dorsal surface, if in contact with the ground, is occupied by a rough callus. Large and remarkable bursæ are sometimes found under the cuboid bone when the deformity has existed for a series of years.[1] The now delicate

[1] Liston, On Diseases of the Bursæ, Lancet, October 21, 1843.

skin of the sole is much wrinkled; the leg is more or less atrophied, and often permanently flexed upon the thigh.

VALGUS.

This form, in which the sole is turned outward, is the opposite of varus.

The first degree is what has been called *flat foot*, and is characterized by obliteration of the arch, with occasional retraction of the extensors of the toes.

In the second degree, the sole is raised from the ground, and the weight of the body is thrown upon the inside of the foot.

The third presents different characteristics, due to the retraction of different muscles. The relations of the bones of the tarsus and metatarsus are altered.

First Degree. — The skeleton is little modified. The ligaments and muscles which unite the extremities of the arched sole are relaxed, while, in some cases, the retraction of the extensors aid in elevating its anterior extremity. The foot is closely applied to the ground, and rotated outward.

Second Degree. — The astragalus is partially luxated backward, and the cuboid and scaphoid displaced externally. The peroneals and extensors of the toes raise the outer border of the foot, the anterior part of which is carried upward and outward, the toes being elevated by their extensors.

Third Degree. — The scaphoid sometimes abandons the internal surface of the head of the astragalus, which then becomes inarticular. The bones of the tarsus separate one from another, yielding to the retracted muscles. The peroneals, the extensors of the toes, the abductor of the little toe, and the accessory muscles are retracted. The metatarsals sometimes leave the anterior articulating facets of the cuneiform, to take a position upon their superior surface, at an acute angle with the leg.

If the tendo Achillis be also contracted, the patient walks upon the central portion of the sole, with the heel and toes raised. In this exaggerated form, a small surface is applied to the ground, and the skin not unfrequently becomes inflamed and ulcerated. The form of the foot varies with the permanent forces applied to it.

It is difficult to imagine that the unaided muscles of the external surface of the leg should overpower the resistance exerted by those of the inner side. Guerin affirms that a pronounced valgus is an indication of a more or less complete paralysis of the gastrocnemius, tibiales, and flexors of the toes. Mr. Little suggests that another reason for the greater frequency of varus is the fact that the flexors and adductors are earlier developed in the fœtal state than the extensors and abductors.

TALUS.

Talus is a name applied to a rare deformity nearly allied to the last, and directly opposed to equinus. The foot is in forced flexion, and the trochlea exposed posteriorly. The retracted muscles are those of the anterior part of the leg and dorsum of the foot. According to Guerin, this affection also implies a paralysis of the antagonizing muscles. The toes are in contact with the front of the leg, and the weight of the body is thrown upon the heel.

In all these forms the original distortion is due rather to the muscles than to the aponeuroses and ligaments, which undergo subsequent retraction.

TREATMENT WITHOUT SECTION OF TENDONS.

Before the introduction of the subcutaneous operation it was common to treat club-foot by the unaided force of machines. Although this principle is still maintained by certain orthopedists, it cannot be deduced from a scientific consideration

of the subject. It is now a well established fact that in certain cases of distortion the tissue of the shortened muscles undergoes a fibrous transformation; and it is highly probable, if not equally certain, that this transformation is in proportion to the degree of tension to which the muscular substance has been subjected. In an old case of varus, for example, the leg and foot form a sort of bent bow, of which the extremities are united by a cord of fibrous tissue, which at once becomes tense when an attempt to straighten the limb is made. It seems obvious that the first step towards straightening the bow is to sever the string which aids in keeping it flexed; and this treatment is in fact indicated, unless it can be shown either that the operation is attended with danger or inconvenience to the patient, or that unaided mechanical treatment is equally efficacious.

Now it is well known that the subcutaneous division of a tendon, when properly performed, is attended with trifling pain, and that there is little or no chance of subsequent inflammatory accidents. On the other hand, very severe pain often accompanies the attempt to elongate a retracted tendon by simple extension. And while few at the present day will dispute that the time occupied by this process is much longer, the deformity is liable to reappear at a subsequent period.

It is not here implied that all cases of distortion demand an indiscriminate division of tendons. On the contrary, there are certain cases of recent deformity, and of disease originating in the joint and not in the muscles, where the tenotome may not be required. In such cases the surgeon should be guided by a knowledge of the original lesion and its effects. If, however, a single rule were required, applicable in a large majority of cases, it should be as follows: *When in distortion of long standing, with a certain degree of motion still remaining in the joint, a tendon*

evidently hinders the limb from assuming a normal position, it should be divided.

Upon this subject Bonnet (de Lyon) thus speaks: "Among children it is often possible to cure club-feet by machines alone, by friction, etc.; but as in easy cases the section of the tendons insures success, abridges the treatment, and avoids pain, and as it is besides perfectly innocent, I believe that recourse should always be had to it except in infants who are to be treated during the first months which follow their birth. It is then so easy to bring the foot into a normal position, that friction and machines, which at a more advanced period of life are only accessories of treatment, become its principal feature, and are adequate alone to produce the desired effect."[1]

The same distinction is made by Guerin between the treatment of the conditions of contraction and retraction.

"Simple contraction permits us to hope for the immediate elongation of the muscles by means proper to effect it, — extension, kneading (*massage*), frictions, etc., — while veritable retraction, or shortening with fibrous degeneration, implies either the impossibility of a return of the muscles to a normal length, or a sufficient mechanical elongation, and demands in consequence the aid of a cutting instrument. Thus, recent deformities by contraction — torticollis, flexion of the limbs, etc. — may be often successfully treated by mechanical and medical agents, while old deformities by retraction demand peremptorily surgical appliances."[2]

For simple mechanical treatment, different methods have been devised.

In the apparatus of Venel the action is lateral; in *varus*, for example, upon the external side of the leg, and the internal surfaces of the foot and heel.

[1] Traité des Sections Tendineuses, etc., Paris, 1841, p. 567.

[2] Vues Générales, etc., Paris, 1840, p. 73.

Delpech employed two machines; the first, to bring the foot straight; the second, to attain the horizontal position.

Dieffenbach and Guerin have employed plaster for the same purpose. The foot, placed in a box, is brought as far as possible into a normal position, and covered with liquid plaster, which is allowed to set. This is subsequently renewed at intervals of two or three weeks. A small hole broken in the mass exhibits the condition of the tissues during treatment. Guerin especially recommends this method, when the delicate and irritable skin of young subjects refuses to submit to the pressure of bandages. The force is equably distributed, while the cuticle is softened by the retained transpiration.

Mechanical aid is occasionally useful for the purpose of rendering a tendon tense and salient before section. But apparatus requires continued care and frequent application, especially in infants, where the tissues, compressed by the straps, diminish in volume, and the foot becomes loose.

SECTION OF TENDONS IN CLUB-FOOT.

Different varieties of the deformity demand the section of different fibrous fasciculi: —

For the elevation of the heel, the tendo Achillis. For the foot raised upon its outer edge, the tibialis anticus; turned upon its internal edge, the peroneus tertius, and all or part of the extensors of the toes. For adduction, the tibialis posticus; for abduction, the peronei longus and brevis.

For the curvature of its internal border, the adductor of the great toe. For the permanent flexion and extension of the toes, their corresponding muscles, both long and short. And finally, when accessory to the distortion, the plantar aponeurosis, and any of the tendinous and muscular fibres of the foot and leg.

In these different varieties of distortion, M. Guerin has

commonly divided the tendons as follows. For *equinus*, the tendo Achillis, and sometimes the flexor proprius of the great toe. For pure *varus*, the tendo Achillis and tibialis posticus. For *varus equinus*, the tibiales anticus and posticus, the tendo Achillis, the extensor proprius and adductor of the great toe, and sometimes the peroneus longus. For *valgus*, the peroneus tertius and the peronei longus and brevis. For *talus*, the tibialis anticus, the peroneus tertius, and the common extensor of the toes. And finally, the plantar aponeurosis, together with other muscles in less common instances.

Before the volume of Bonnet (de Lyon), published in 1841, I believe no writer had minutely described the manner of dividing the different tendons of the leg. Operations upon the tendo Achillis and tibialis anticus were already the subject of various memoirs; but the tibialis posticus and the peroneals of the ankle had not at that time been divided upon the living subject, although their position was indicated by Velpeau, with a view to their section. Duval, in his second edition, published in 1843, gives certain details upon this point.

The manual of the subcutaneous operation has been already indicated in general terms. The tendon is made salient if possible. A fold of skin being pinched up at one end between the thumb and finger of the operator's left hand, the other end is confided to an aid, and the tenotome introduced by a simple puncture at its base. The fold is then released so that the puncture may recede to a distance from the point of section, and the tendon is divided by a sawing motion.

Tendo Achillis. — The patient commonly lies upon his belly, though Dieffenbach prefers a kneeling position.

The place of section is of importance. Duval and some other writers merely indicate a point an inch or two above the calcaneum. This distance must evidently vary with the

dimensions of the limb, and certain other considerations, but as a general rule the most salient point should be preferred. While the muscular fibres are to be avoided above, the want of vitality in the tissues forbids a section too near the bone of the heel.

When the tendon is contracted it sometimes approaches the posterior tibial artery and veins. These are avoided by receding from the heel.

Scoutetten describes a bursa mucosa near the calcaneum, the puncture of which might liberate the synovial secretion in sufficient quantity to interfere with a reunion of the tendon.

Authorities are divided upon the direction of the section. Stromeyer, Scoutetten, and Duval cut from the bone toward the surface, while Bouvier, Dieffenbach, Guerin, and many other surgeons, enter the knife beneath the integuments, and incise toward the bone. It is, in general, a matter of little importance whether the section be commenced upon the anterior or posterior surface of the tendon. When, however, the tendon so nearly approaches the posterior tibial artery, with its accompanying veins and nerve, that it is difficult to engage it alone upon the blade, it is evidently better to cut toward the bone, that the edge may repel the yielding vessels.

If a pointed tenotome be employed, it should be hindered from piercing the integuments of the opposite surface. The safest plan is to employ a blunt tenotome, a puncture being first made with a lancet or pointed knife.

Most surgeons prefer to make this aperture upon the inside of the heel, — a preference for which no strong reason is offered. The integuments are somewhat more lax and the tendon is occasionally more voluminous upon that side, but the slender tendon of the plantaris is there almost directly beneath the instrument.

A fold of the integument being pinched up, and the tenotome being introduced at its base, the foot is extended by the operator, and the tendon, when tense, severed by a sawing movement of the blade. The moment of section is accompanied with a noise, and with a separation of the extremities in most cases, although the bones are sometimes so distorted, or other tendons so retracted, that this separation is inconsiderable. The air being carefully excluded, and the blood expelled, as far as practicable, the wound is closed with adhesive plaster.

The division of other tendons may precede or follow that of the tendo Achillis. Velpeau divides, in the same operation, all the retracted tendons. Phillips, Duval, and others seek first to reduce the complicated varieties of the deformity to the simple form of equinus, and then the tendo Achillis is subsequently divided. Both methods recommend themselves by their results, but the latter is more generally adopted.

Tibialis Anticus. — This muscle is best divided at its most salient point, a few lines below the annular ligament. Beneath is the articulation of the astragalus with the tibia and fibula, which might be endangered by too deep a section. M. Bonnet asserts that the division of the tendo Achillis often relaxes the tibialis anticus, and obviates the necessity of its section.

Tibialis Posticus. — Certain cases of exaggerated distortion have been supposed to demand the section of this tendon, though the operation is comparatively rare, and of difficult execution. Behind the tibia it is enclosed in a sheath, in the neighborhood of an artery of considerable size. Some anatomical knowledge is required to reach its position below the ankle, since it is rarely salient, and its section is unattended with perceptible separation of its extremities. In cases of complicated equinus, when the scaphoid is at a

distance from the external malleolus, the following method of M. Bonnet may be adopted. The eminence of the head of the scaphoid being found, the tenotome is entered at a quarter of an inch above, and a little in front of it, and advanced till it meets the astragalus. The instrument is then slid along against the bone until its extremity arrives at a point four or five lines beneath the prominence of the scaphoid. If the edge of the tenotome be now raised until it reaches the skin, the tendon is with certainty divided. This method is inapplicable in the more marked degrees of varus.

The Extensors of the Toes should be severed at their most prominent point, commonly at the articulation of the metatarsals with the phalanges.

Peronei Longus and Brevis. — These tendons are enclosed in a fibrous sheath, above or below which they may be divided. Above, they are occasionally quite prominent. The position to be chosen below is about half an inch in front of the ankle, and as was indicated for the tibialis posticus. The surest method consists in introducing the pointed tenotome behind the tendon, and cutting from within outward. This position endangers the articulation less, and allows the instrument to pass free of a protuberance situated upon the external side of the calcaneum.

Flexor Communis and Flexor Longus Pollicis. — The depth of these tendons renders their section difficult elsewhere than on a line with the first phalanges of the toes.

The blade is slid beneath, and advanced to the surface. The short flexors may be included in the section.

The *Plantar Aponeurosis* is often retracted, and requires division. The tenotome should be introduced at the inner edge of the foot, where the fibres are in strong relief, commonly at a point near the articulation of the first with the second range of the tarsus. The section should not be

carried so deep as to wound the articulation. This is perhaps the most painful of these operations.

The narrow blade being carefully withdrawn without enlarging the puncture, the blood and any accidental bubble of air are expressed. The finger is kept upon the wound until a bit of adhesive plaster is made ready and applied, so as to seal the orifice hermetically.

The foot may be then enveloped for an hour or two with a wet compress, which relieves a local burning pain sometimes experienced by the patient.

A redivision of this tendon is occasionally required during the mechanical treatment, and is indicated by the resistance and prominence of the tendon. A twice or thrice repeated section is not uncommon, nor is it objectionable; but the tendo Achillis has been unjustifiably divided upwards of twenty times upon the same individual.

The new division should be effected a short distance above the cicatrix which occupies the position of the previous section.

MECHANICAL TREATMENT.

It has been a question whether force should be immediately applied after the section of tendons, or whether it should be delayed to a subsequent period. Velpeau gives preference to immediate mechanical treatment. Duval, while he recommends the foot to be at once placed in a machine, to retain any advantage that may have been gained by the section alone, deprecates immediate extension. I believe that many of the inflammatory accidents so frequently reported as results of tenotomy are to be attributed to a too hasty application of force. It may be asserted that a large majority of European orthopedic surgeons follow the example of Stromeyer, and wait for the cicatrization of the puncture before applying extension to the limb. In this country this

practice was recommended by Dr. Hayward of Boston as long ago as 1841.[1]

At the end of forty-eight or seventy-two hours, or even a much longer period, when the integuments are united, and the tendon has set up a restorative process, force may be gently applied.

The adjustment of a machine requires much immediate and subsequent care. A gradual and long continued force alone will induce the foot to resume its normal position. The foot is unequally covered with tissues, and a slight pressure, even of a strap, a lump of cotton, or a fold of bandage, becomes painful where the bone projects. This is especially true of thin subjects.

The pain is in general dull, though sometimes insupportable. In *equinus* the great toe and instep are more frequently the seat of pain, while in the treatment of varus it occupies the external border of the foot, is lancinating, and is exacerbated by the warmth of the bed.

If the pressure be continued, the skin becomes red, hot, and exhibits a gangrenous vesicle, followed by slough and ulceration. At other times the foot is much swelled, while the limb, especially in scrofulous subjects, becomes more or less œdematous.

When the pain is local and permanent, the apparatus should be removed, and the skin, if red, soothed with emollient and narcotic lotions. At the end of a few hours the machine may be reapplied, the spot being well protected with cotton. In case of an eschar, the ulcer should be allowed to heal before any attempt to continue mechanical treatment is made.

The first application of a machine is always ineffectual. The tissues require time to accustom and adapt themselves to their new position. They are impatient of force, or are

[1] Boston Medical and Surgical Journal, 1841, p. 313.

so compressed that the foot becomes loose in the machine. When it is necessary to change the apparatus, it is important to maintain the foot in its new position during the process. If allowed to escape from the hand for a moment, it tends to resume its recent form, a movement accompanied with great pain. The part should be kept cool. During the first ten or twelve days it is well to examine the apparatus once or twice a day. It is better also to increase extension in the morning rather than the evening, when the consequent pain sometimes hinders the patient from sleeping. A want of attention to these details may involve the necessity of suspending the treatment and the progress of several days is sometimes lost in a short time.

MACHINES.

It remains to describe some of the principal machines employed in the treatment of club-foot. The principles and aim of most of them are the same. They offer different mechanical combinations, which belong rather to the mechanician than the surgeon. It is this peculiarity, together with the assiduous care required in the use of apparatus, which has led to the establishment of institutions devoted to the treatment of deformity, and has created a class of specialists known as "orthopedists."

The machines may be described as consisting of a series of pieces, each adapted to a corresponding detached portion of the skeleton, and united by joints, the movements of which represent those of the articulations.

The apparatus should be capable of conforming itself to the curve of the distorted limb, and provided with screws, or other mechanical contrivances, for forcibly restoring the parts to a normal position. (Figs. 16, 17, 18.)

EQUINUS.

When the deviation is slight, it suffices, after section of the tendons, to confine the foot in a common boot, the leg of which is of stiff cowhide, and laced in front. The starched bandage is also employed with success for this purpose.

If the distortion is great, these methods are insufficient, and it becomes necessary to employ a certain amount of force. The machine of Stromeyer, and the boot of Scarpa, may be regarded as the type of such apparatus, and have undergone various modifications.

The Machine of Stromeyer (Fig. 14), employed by Dieffenbach, consists of two bars of wood extending from the ham to the ankle on each side of the leg, and united by cross-pieces at top and bottom. A third sliding cross-piece, capable of being fixed by screws, serves as an axis of flexion and extension to a piece of board which corresponds to the sole of the foot. The flexion of this wooden sole is effected by two cords, which, attached to its upper corners, traverse pulleys at the upper part of the parallel bars, and return to a roller governed by a ratchet at the lower extremity. The calf of the leg rests upon a sheet of leather attached to the parallel bars, and is secured by straps.

Scarpa's Boot (Fig. 15), which has been modified by Guerin, Phillips, and others, presents a sort of shoe open at top, and united by straps. At the ankle it is articulated with two lateral uprights of metal, which are bound to the leg at intervals by wadded straps. The flexion of this joint is governed by a screw fixed by its extremity to the sole, and passing obliquely to one of the metal uprights. The sole itself is sometimes jointed, and admits of a lateral movement, which accommodates it to the lateral varieties of club-foot. It is governed by a screw upon its edge.[1]

[1] Modifications of these joints will be found in the drawings.

The machine of Stromeyer is possessed of greater force than the boot of Scarpa, while the latter is more portable. The boot, worn to advantage during the day, may be replaced by the machine of Stromeyer at night.

VARUS.

The treatment of varus is more difficult, the resistance of the skeleton in the exaggerated forms being often great.

In young children it sometimes suffices to sever the tendo Achillis, and apply subsequently the starched bandage. For older children the boot of Scarpa may be employed. Phillips, Duval, and Little prefer, when the deviation is great, to attack the distortion of adduction, and to convert the form of varus into simple equinus before dividing the tendo Achillis. If this method be adopted, the result may be attained in the following way. The leg, when the punctures are healed, should be enveloped in wadding which is confined by a bandage (Fig. 19). A long splint, mortised at its extremities, is cushioned and applied to the external surface of the leg, extending from the knee to about six inches below the heel. The superior extremity is fixed to the head of the fibula by a band, which, after passing through the mortise, is continued around the leg to the heel, and starched. The splint being thus bound to the leg, its lower and projecting extremity serves as a point of attachment to a band, which is fixed by several turns to the end of the foot, and serves to draw it outward. The varus is thus gradually converted into equinus.

An Ingenious Method of Dieffenbach (Fig. 20) applies to certain cases of slight deviation. The middle of a yard of starched band, looped round the inside of the heel, crossed on the outer ankle and adhering to the calf, tends to draw the heel outward. A similar loop, not starched, is allowed to hang loose a few inches below the inner ankle and sole,

and is firmly bandaged to the internal surface of the leg. A long splint, terminated by a lateral notch, which is engaged in this loop, is now bound to the external surface, as high as the knee, and the apparatus is complete. It will be observed that the splint acts as a lever over the outer ankle, which serves as a fulcrum to draw the sole outward by means of the loop round its extremity. If the patient walks, the splint is driven upward and outward, and the foot necessarily follows it.

Among the machines which conform to the deviation of the foot, those of Bouvier and of Duval may be mentioned.

The Machine of Bouvier consists of a jointed sandal attached to a lever, which, acting over the ankle, carries the foot outward as its superior extremity approaches the leg.

The Apparatus of Duval (Figs. 22, 23) is complicated in appearance, but is little more than the sandal of Scarpa's boot, attached by a universal joint to a leg-piece. The joint is governed by two perpetual screws. An upright, which extends from the inner side of the sole to the ankle, is furnished with a cushioned metal plate, which may be advanced against the heel by screws from behind (Fig. 22, *b*).

The Apparatus of Little, copied from the Lancet, February 24, 1844, will be readily understood from the drawing (Fig. 21).

VALGUS.

In the simpler forms of valgus, a starched bandage sometimes suffices after section of the tendo Achillis. If complicated, the splint may be used to reduce it to the form of equinus, as was indicated for varus. The splint should here be applied on the internal surface of the leg.

OTHER METHODS.

The treatment of club-foot by means of a plaster mould has been already described. In the less exaggerated varieties of distortion, and especially in children, the foot may be gradually brought down by a sole, or sort of shoe, attached to bands of wrought iron so thin as to allow of being bent to the required position, and stiff enough to retain it.

While the common expedients of mechanical treatment have been described, it is obvious that its purpose may be equally effected by a variety of combinations, the details of which are here unnecessary.

GENERAL REMARKS.

Before submitting the limb to the action of a machine, especially of the more powerful kind, it is of great importance that it should be adequately protected. It should be enveloped in a soft roller, and afterwards covered with cotton, especially at the points of puncture. The salient parts being then wadded, and the cavities carefully filled, the cotton should be kept in place by another roller. Any fold or inequality is now to be arranged, and the whole covered with a stocking. The limb thus swathed is placed in the machine, and the straps successively fastened. In general, the apparatus should be at first loosely applied. As the foot becomes accustomed to pressure, the straps may be drawn tighter, and the force gently augmented. When the patient complains of pain, relief is sometimes afforded by loosening the straps and inserting fresh wadding. A continuance of the pain demands that the foot should be removed from the apparatus, and the skin exposed, with a view to the local treatment elsewhere described.

TORTICOLLIS.

THE division of the sterno-cleido-mastoid muscle with the adjacent integuments has been performed by surgeons for the last two centuries.

The operation by a simple puncture is of more recent date. Dupuytren practised this method in 1822, and in 1826 and 1830 Stromeyer and Dieffenbach published similar operations of their own. In France the method was reproduced by Amussat, Bouvier, and Guerin in the years 1836, 1837, and 1838. The last named writer has since materially modified the operation, and has thrown much light upon the affection for which it is practised.

CAUSES.

The agents of this distortion may be considered in two classes; the first includes the varieties in which the contraction or retraction of the sterno-cleido-mastoid is the chief source of the affection, while to the second are referred all other causes. To the former, the operation about to be considered is in most cases applicable; to the latter, much less frequently. Among this latter class are: —

Caries of the bone, — indicated especially by the history of the lesion.

An inflammation of the synovial capsules and fibrous tissues of the cervical vertebræ, which Bouvier has called *articular torticollis.* It is either acute or chronic. Distortion results from the long continued efforts of the patient to relieve the tense and painful ligaments, by displacing them in a direction which the head ultimately retains.

Abscesses and cicatrices in the cervical region.

Tumors and glandular engorgements, so considerable as to force the head for a length of time from its normal posi-

tion. To this last cause Duval attributes thirty out of sixty cases treated by himself, and in which the disease was followed in two or three months by permanent shortening of the muscles.[1]

Paralysis of the muscles of one side, the head yielding to the unantagonized force exerted by the opposite side. The cervical column is not curved, but the last cervical is inclined upon the first dorsal vertebra. In efforts to bow the head, the chin turns to the paralyzed side. In this form the distortion, if exaggerated, may be partially relieved by a section of the healthy muscle.

The principal causes which directly affect the muscle are: —

Active muscular contraction, with subsequent retraction, atrophy, and fibrous transformation. To this agency most cases of congenital torticollis are due.

Muscular rheumatism of the sterno-cleido-mastoid muscle, and the retraction which may result from it.

The action of forceps applied during labor. The muscle is torn, and blood effused, much as when subcutaneously divided. Simple contusion sometimes suffices to produce inflammation, followed by retraction.

The deviation is more frequent to the right than to the left. According to Phillips, two thirds of the cases of this distortion due to muscular contraction are directed to this side; and in connection with the last cause of the lesion, it may be mentioned that in seventy per cent of ordinary labors the head is presented in the "first position."

The form of torticollis about to be considered recognizes muscular retraction as its immediate cause. The muscles are either idiopathically affected, or are retracted at a period subsequent to the original lesion; so that the head, for a length of time displaced, by glandular enlargement or otherwise,

[1] *Op. cit.*, p. 513.

is retained in its abnormal position by the muscular fibres, which accommodate themselves to their new relations.

SYMPTOMS.

The head deviates in various degrees, to the right or left of the normal position. In the exaggerated forms, the chin is raised in the air, while the head is rotated, and depressed upon the shoulder of the affected side. In this situation the face changes its expression; the features of the depressed side become in a measure atrophied; the brow falls, and the cheek becomes less prominent.

In the region of the sterno-cleido-mastoid muscle a dense cord is felt, which becomes more prominent and resisting if force be applied to the head in a direction opposed to its action.

The shoulder of the contracted side is drawn upward and forward, so that the sternum and the centre of the thorax, being no longer upon the same plane with the shoulder, are apparently depressed. Much pain, with a sensation of dragging, is sometimes experienced in the affected side, increased by atmospheric influences, after exertion, and in bed.

STERNO-CLEIDO-MASTOID MUSCLE.

M. Guerin considers this a double muscle, of which the two parts, endowed with different functions, may be separately affected.

The following are his propositions: [1] —

The sterno-cleido-mastoideus consists of two distinct muscles, the sterno-mastoideus and the cleido-mastoideus.

The sterno-mastoideus and the cleido-mastoideus are possessed of separate functions. The first is especially a motor of the head, the other is essentially an inspirator muscle.

[1] Mémoire sur une Nouvelle Méthode de Traitement du Torticollis Ancien, Paris, 1843, p. 186.

In torticollis, till now attributed to the shortening of the entire sterno-cleido-mastoideus, the sternal portion of the muscle may be alone primitively affected.

In the treatment of chronic torticollis, due to the shortening of the sterno-mastoideus, the section of the sternal portion may suffice for the disappearance of the essential cause of the deformity.

The division of the sternal insertion of the muscle is in certain cases followed by a more or less gradual restoration of the head to a normal position. Such cases are reported by Duval and other writers. In other cases it is insufficient, and it is necessary to divide the clavicular portion also. Bonnet[1] remarks that it is far from sufficing in all cases; and that four times out of five he was compelled to divide the clavicular fasciculus at a later period before the distortion yielded.

VERTEBRAL COLUMN.

The head being carried out of the centre of gravity, the vertebral column institutes a series of curves with a view of restoring the equilibrium. They are of two kinds. The first is general, and involves all the vertebral articulations.

The second, described by Guerin, is local, and occurs at the intervals of the last lumbar vertebra with the sacrum, of the eleventh and twelfth dorsals, and of the seventh cervical and first dorsal. From this inclination of "locality," (which is an exaggeration of the normal movements of the articulations), a series of re-entering angles results, common to the spines of all subjects affected with chronic torticollis, and continuing after the division of the muscles of the neck.

TREATMENT WITHOUT SECTION.

Before the disease assumes a chronic form, while the muscle is yet in a state of simple contraction, the deformity sometimes yields to medical treatment, such as kneading, alternate

[1] *Op. cit.*, p. 582.

flexion and extension, and friction. M. Guerin especially recommends local friction with the tartar-emetic ointment, the development of the pustules being sometimes simultaneous with the restoration of the head to a normal position.

It should be remarked that the sterno-mastoid muscle is not the sole cause of distortion in chronic cases. Other cervical muscles participate in the affection, and a prolonged treatment is required to counteract their efforts, even after the division of the fibres of the sterno-mastoid. Neither is the exaggerated form of distortion completely relieved by surgical aid. A certain inclination of the head often continues, and the features and facial bones, atrophied upon the depressed side, rarely regain their normal outline.

The age of the patient is another important consideration. M. Bonnet places the limit at fifteen years; after which a perfect restoration of the parts, in the chronic form of the lesion, can no longer be expected.

SECTION OF THE STERNO-CLEIDO-MASTOID MUSCLE.

Before the adoption of the subcutaneous operation, it was common to divide the integuments transversely; after which the muscular fibres were severed, layer by layer. Such was the operation practised by Brodie, Warren, Roux, and others. Of late years the subcutaneous method has been generally adopted.

Although the section of one, commonly of the sternal insertion, sometimes suffices, it is often necessary to divide both tendons. Guerin, who for a time sustained the former practice, has since divided, in many cases, both fasciculi.

It is usual first to attack the most prominent of the two tendons, after which the other becomes more tense and may be divided either immediately, or after an interval of a few days as suggested by Bonnet. In certain cases the whole muscle may be divided at once.

There has been much discussion upon the merits of different sections. It has been doubted whether the puncture should be made from within outward, and the section practised from the deep to the superficial parts, or *vice versa;* and much unnecessary importance has been attached to these differences.

As a general rule, the point of section is at a short distance above the sternum. Guerin gives the distance of six or eight lines; Phillips, an inch; Duval, half or three quarters of an inch. This will evidently vary in different subjects.

It occasionally happens that the tendon offers no prominence near the clavicle, and it becomes necessary to divide it at its most salient point, two or three inches above. The hemorrhage which follows a muscular section is sufficient reason for proscribing this point when it can be avoided. The section of the superior extremity has long since been abandoned.

The following are the principal methods.

Method of Dieffenbach. — The patient being seated, an aid standing behind draws the head in the direction opposed to the deviation, while a second aid depresses the elbow and shoulder of the affected side. The muscle being thus made tense, the operator pinches it up between his thumb and finger, and passes a small curved bistoury beneath it, at a short distance above the sternum. When the point is felt under the skin of the opposite side, the knife is slowly withdrawn, and the muscle, being pressed against its edge, is in this way severed.

Duval's Method. — The patient is placed in the position just indicated, and the tendon made salient. For the sternal insertion, the tenotome is introduced at its posterior surface, from within outward. In this case, the surgeon being in front of his patient, the right hand is employed for the right muscle, and the left hand for the left. For the clavicular insertion, the knife is introduced behind the most salient

edge, whether external or internal, and the tendon is divided, from the deep to the superficial layers. When the tendinous fasciculus is not marked beneath the skin, a puncture is made with a lancet, through which a blunt tenotome is carried to the opposite border of the muscle.

On three occasions M. Duval divided the whole muscle by the adoption of a single puncture at the internal border of the sternal insertion, and once by that of a puncture at the external border of the clavicular extremity.

Guerin's Methods. Sterno-mastoid.—The patient lies upon a bed, the upper part of which is elevated. An aid turns the head so as at once to oppose the inclination and exaggerate the existing rotation. In this way the muscle is extended, and carried into an anterior plane,—detached as it were from the subjacent parts. A fold of skin is raised parallel with the muscle, and the tenotome introduced flatwise, at a point corresponding, when the skin is relaxed, with the external border of the muscle, and six or eight lines above its insertion. The fold being released, the edge of the tenotome, previously turned upward, is pressed upon the muscle, which is thus divided. The tenotome here employed is peculiar, and concave upon the edge. (Fig. 12.)

In the second method, less effectual than the last, and less employed, a convex tenotome is introduced beneath the tendon. The use of a grooved director is objectionable, upon the ground that it traverses the tissues with difficulty.

Cleido-mastoid.—The muscle being put in tension, and a fold raised, the instrument is introduced upon its inner border, eight lines above its insertion, and the division is effected from the skin towards the centre; so that the two insertions may be successively severed in opposite directions by means of a single puncture in their interval,

There is little danger of wounding the larger vessels, especially in the methods of Guerin. It has been shown how

the muscle is carried into a plane anterior to these vessels. By making the puncture near the clavicle, we avoid the anterior jugular vein in its passage to the subclavian. The primitive carotid artery and internal jugular vein are protected by the sterno-hyoid and sterno-thyroid muscles, and correspond in both sections to the base of the blade of the knife. In dividing the cleido-mastoid, the anterior jugular, when it exists, may be left between the back of the instrument and the skin, if the knife be introduced in a position perpendicular to the muscular fibres and not flatwise.

Should a second section become necessary at a subsequent period, certain precautions are requisite. The adhesive action and its resultant cicatrix may displace the larger vessels, and Duval suggests that an interval of six months should be allowed to elapse before the section is repeated, in order that the newly formed substance may completely insulate itself from the surrounding parts.

The complete division of the muscle, in all these methods, is attended with a slight snapping sound, deepened by the proximity of the chest, and also by a sudden separation of the two ends of the divided muscle and a corresponding movement of the head. As soon as the knife is withdrawn, the blood is to be expressed from the wound, and the puncture hermetically sealed with a bit of adhesive plaster of the size of a shilling. A compress and roller complete the dressing. Great care is requisite to prevent the admission of air into the wound. Pus in this region sometimes infiltrates the anterior mediastinum. Once formed, the pus should be allowed to escape, although, when fluctuation is first perceptible, compression sometimes favors the absorption of the fluid. For this purpose, a ball of lint is placed upon the tumor, and, being covered with compresses, is maintained by long strips of adhesive plaster, extending from the back upon the chest.

With a little attention to diet and repose, however, especially

if the air has been excluded from the wound, these accidents are avoided. The wound commonly heals by the third day, and mechanical treatment may be then commenced.

SECTION OF OTHER MUSCLES.

The division of the sterno-cleido-mastoid muscle sometimes relieves the deformity but incompletely. It is then important to ascertain whether other muscular fibres aid in retaining the head in its abnormal position, in which case they become tense, oppose any effort to replace the head, and require division. Portions of the trapezius and platysma have been divided.

MECHANICAL TREATMENT.

The aim of mechanical treatment is twofold. To adjust the head in a normal position; to correct the curves of the vertebral column.

When the deformity is slight, the spinal distortion is also inconsiderable, and attention should be chiefly directed to the position of the head upon the cervical vertebræ. In adult patients, and in the exaggerated varieties, it becomes necessary to apply force to the vertebræ, both in the cervical and dorsal regions. The apparatus is then complicated.

Among the more simple means of commanding the head are the following: —

A cravat of pasteboard or boiled leather, as employed by Guerin, is simple, and almost universally adopted in ordinary cases. Its height may vary at different points. A substitute is a circle of stiff wire, so bent as to correspond with the edges of such a cravat.

A band carried around the head horizontally, and united to vertical bands over the crown from before backward, and from ear to ear. A band fastened to the first, at the mastoid process of the healthy side, is drawn down in front and

attached upon the chest or at the waist, so as to aid the action of the healthy muscle. A cap may be substituted for the bands upon the head.

The temporo-axillary bandage of Mayor. The base of a triangular handkerchief is applied to the temple of the affected side, and the extremities brought, one round the forehead, the other round the occiput, to be united below the axilla of the sound side. A horizontal band may be added to this bandage.

The last two methods tend rather to increase than diminish the cervical inclination, and are therefore only applicable in slight deviation, or as temporary substitutes for other apparatus.

A complete machine, the force of which is adapted as well to the spine as the head, is complicated and expensive. Various models have at different times been contrived for this purpose. They are adapted either to the horizontal or upright position. The former have received the name of orthopedic beds, and are chiefly modifications of those of Shaw and of Guerin.

An apparatus which permits locomotion demonstrates its leading features in the "Minerva" of Delacroix, and takes its point of counter extension upon the pelvis or the shoulders.

The Apparatus of Bouvier, modified from the Minerva, consists of a wide metallic belt resting upon the hips and haunches. To this is fastened a steel upright in the form of a T, which occupies the region of the spine and scapulæ, and is retained by shoulder straps. A firm point of counter extension is thus obtained between the shoulders, to which is attached an upright bar, from which the head is suspended.

The head is secured by a horizontal metallic band, descending upon the mastoid processes, which gives attachment to vertical straps for the crown and chin. The iron rod by

which it is attached to the steel plate between the shoulders is so contrived as to admit of elongation, extension, flexion, rotation, and lateral inclination, in any of which positions it may be fixed. (Fig. 24.)

Cravat of Phillips. — A large triangular piece of sheet iron, well cushioned, is adapted to the back of the chest, the base corresponding to the shoulders. A strap confines it around the hips. The chief support is derived from broad wadded suspenders, which secure it over the shoulders. To this triangle is fastened an upright of iron, capable of being raised or depressed, and terminated above by a tooth, corresponding in position and use to the odontoid process. Upon this rotates, by means of a socket, a stuffed collar of iron which supports the chin. This contrivance is cheap and effectual. (Figs. 25, 27.)

The Orthopedic Bed of Guerin is modified from that of Shaw. It consists of a divided bed, of which the superior point of division corresponds to the union of the cervical and dorsal regions, instead of the central dorsal region, as in that employed for lateral curvature of the spine. (Figs. 31, 34.) The body is secured upon the bed, and appropriate lateral force is applied. The head is confined in a helmet and is secured by a collar adjusted to the chin. The movements of this helmet, which are thus communicated to the head, are universal and graduated.[1]

An inclined plane, to the head of which the chin is attached by a handkerchief passing under it, is serviceable in certain cases. Extension is then effected by the weight of the body.

[1] The details of the machinery, obvious to an ingenious mechanist, but requiring a long description, may be found in Guerin's last edition of "Torticollis," Paris, 1843. I am not persuaded that this mechanism is the simplest and most effectual.

FALSE ANCHYLOSIS OF THE KNEE JOINT.

THE division of tendons is much less effective in deformities of the knee than in those of the foot. While club-foot depends in a majority of cases upon muscular retraction, without lesion of the synovial surfaces, distortion of the knee rarely originates in this cause. It commonly results from disease, either of the cavity of the joint, or of its investing membranes. Duval refers fifteen cases in twenty to sub-inflammation of this articulation. The change in the form and character of the tissues is then so considerable as often to render it difficult to restore the normal shape of the limb or its functions. Most cases, however, are susceptible of amelioration from treatment, and it is sometimes possible both to straighten the limb and to restore its suspended movements.

CAUSES.

Congenital Retraction. — This variety of the affection is analogous to other congenital deformities, and is accompanied with the fibrous transformation of the retracted muscles. As in the operation for club-foot, their section then facilitates the subsequent mechanical treatment. Muscular retraction materially interferes with the development of the bones and other parts in early life; and the limb rarely or never regains its normal length and outline if the operation be deferred till adult age. As an idiopathic affection of the knee, it is comparatively rare.

Permanent Flexion. — In this position of the leg the muscles become after a time passively retracted, and require equally division. It is unnecessary here to inquire what agencies contribute to the position, so common in chronic diseases of this articulation. By the flexion of the knee,

most of the muscles are relaxed. It is the natural position when the patient lies on the side, and the necessary one when the synovial cavity is distended with fluid.

It is also sufficient to know that in a large majority of cases of long standing, resulting from both these causes, adhesions are formed between the articulating surfaces; and in this connection it is unimportant whether they presuppose synovial inflammation, or whether, as Hunter suggested, and as seems to follow from the recent investigations of M. Teissier,[1] a simple state of rest may cause vascularity of the synovial, and the deposit of false membranes.

Serious Lesion of the Joint. — The most common form of false anchylosis is that in which the articulating surface is materially altered; where chronic inflammation, ulceration, and the lesions commonly accompanied by the white swelling, have occasioned long continued suppuration, cicatrices and change in the form of the cartilaginous and bony extremities.

The following are the principal changes which result from long continued flexion of the joint in disease of this sort.

PATHOLOGICAL ALTERATIONS OF THE TISSUES, AND THEIR CONSEQUENCES.

The entire limb is commonly withered and atrophied.

Spontaneous Luxation. — The weight of the flexed leg resting upon the heel in a horizontal position, aided by the action of the flexor muscles, inclines the head of the tibia backward, and the joint tends to open behind; while the distended condition of the lateral and posterior ligaments finally permits this bone to glide back upon the posterior surface of the condyles of the femur, which are often atrophied at that part.

Rotation. — The powerful action of the biceps flexor, the shape of the condyles, the disposition of the crucial liga-

[1] Gazette Médicale, tom. ix. pp. 609–626.

ments, and the position of the leg, which the patient supports upon the outer side of the heel, tend to impress upon it a movement of rotation outward, often considerable. Duval refers to a case in which the internal condyle of the femur was received into the external concave surface of the tibia, there being a semiluxation of the tibia upon the femur. These partial luxations, according to Bonnet, accompany three fourths of the cases of angular anchylosis of the knee.

Outward luxation of the patella generally accompanies rotation of the tibia.

Change of Form in the Articulating Extremities. — The parts in contact undergo ulceration and absorption. The pressure of the condyles of the tibia, often ulcerated themselves, occasions extensive absorption of the posterior part of the condyles of the femur, which are sometimes excavated to the depth of half an inch or more. The pressure of the patella upon the external condyle in front destroys its convexity.

Adhesions. — The patella is sometimes glued to the anterior part of the femur, and sometimes to the interval between the femur and tibia, in which case it is impossible to straighten the limb. The cartilages of the anterior part of the femur are sometimes absorbed, and the two bones become intimately united by fibro-cellular bands, in a way to obliterate the anterior half of the cavity of the synovial membrane.[1] Finally, masses of fibrous tissue surround the joint, occupying especially the popliteal region, where they envelop the vessels and nerves, and form a compact mass. A dissection was exhibited by M. Chassaignac to the Anatomical Society of Paris, in which the popliteal artery was so contracted by these adhesions, and embedded in them, that any attempt at sudden extension of the limb must have produced its rupture.

[1] Bonnet, p. 560.

DIAGNOSIS OF THE DIFFERENT ORGANIC LESIONS.

While the disease is in an active state, besides the constitutional symptoms, the knee is often much enlarged. It may present the peculiar doughy feeling which sometimes accompanies sub-inflammatory action in this region, or may be distended with fluid. There is generally more or less pain upon movement, however slight.

When the popliteal nerve is retracted, probably by virtue of its fibrous sheath, it is of manifest importance to distinguish it from the tendons, which present a similar elevation in the ham. Their relations, however, are different. While the tendons may be traced to the condyles of the femur, the nerve traverses the area of the popliteal triangle and occupies the space between the condyles.

The position of the bones is easily detected. The luxation and rotation of the tibia is indicated by the corresponding and evident modification of the outline of the limb, and by the outward direction of the toe, when the anterior part of the thigh is made to look directly forward.

The absorption or disintegration of the articulating surfaces is difficult to be detected, and must be inferred from the duration of the disease, the position of the limb and of the patella, and from the amount of suppuration.

The existence of fibrous tissues is to be inferred from the resistance of the soft parts, and the cicatrices of fistulous passages.

Adhesions are less difficult to be recognized than ulcerations of the articulating surfaces. The union of the tibia and femur is indicated by the absence of all movement. The adhesion of the patella should not be confounded with its immobility resulting from the tenseness of the ligaments when the leg is flexed. When the patella is adherent, we

may always infer the obliteration of the anterior part of the cavity of the joint.[1]

It is, however, in some cases difficult to distinguish true from false anchylosis, — the bony from the fibrous union of the parts. The pain produced by the forced flexion of the joint is an uncertain test. Perhaps the surest indication that the union is false is the possibility of still producing a certain amount of flexion beyond the point at which the knee is stationary, and hindered from extension by the retracted muscles. The limb can then in most cases be straightened. But when the joint is entirely deprived of the power of flexion, it is probable that the anchylosis is bony; and in such cases, even when the osseous deposit is inconsiderable, it is doubtful if the degree of flexion has ever been diminished. It is of less importance to distinguish true anchylosis, imperfect though it be, from the complete fibrous union of the synovial surfaces which sometimes follows rheumatic affection, since this lesion also offers serious obstacles to mechanical treatment.

Passive flexion of the joint is sometimes diminished, or entirely prevented, during the examination of the patient, by the active contraction of the muscles, so that capability of motion may exist where it is not detected. In such cases, if the attention of the patient be diverted, the muscles become relaxed, and a certain power of movement is found still to exist; but, as was before stated, it is commonly in the direction of flexion, extension being prohibited by the passively contracted muscles. In examining the limb, the alternate forced movement which stimulates the contraction of the muscles may be estimated, by measuring, as Duval recommends, the distance between the ischium and heel, in each position, the pelvis being fixed. If there is a difference in the measurements, the union is false.

[1] Bonnet, p. 571.

TREATMENT.

The treatment of false anchylosis of the knee joint may be considered under three general heads:—

The division of the tendons which oppose extension.

The extension of the limb.

The reproduction of its normal movements.

The evidence of the results of treatment is far from satisfactory. Thus, in the serious lesion of the joint already alluded to, Bonnet maintains that the section of tendons is never practised with success; Phillips is less decided as to the efficacy of treatment, while Duval offers numerous observations of distortion from lesion of this sort, accompanied with suppuration and subsequent cicatrices, in which treatment produced a straight and serviceable limb.

The results of these cases seem to have varied, not only with the character and degree of the lesion, but with the nature of the mechanical treatment; and it is therefore important to estimate the value both of the indications for treatment and of the different methods of applying mechanical force.

Of the former, one of the most promising is the possibility of still executing a certain degree of flexion. Duval does not hesitate to affirm that by means of subcutaneous sections entire extension can always be obtained, provided the anchylosis is false or incomplete. But it is evident that, without the indication afforded by the capability of flexion, it is difficult, if not impossible, to establish this important point. There is little or no recorded evidence to show that the limb has ever been reinstated when the joint was entirely destitute of the power of motion, that is, of flexion; while, on the contrary, it frequently happens that all efforts fail to produce any modification in the outline of the limb. The cavity of the joint has then become the repository of

organized lymph, which has soldered together the articulating surfaces.[1] In time, this lymph is transformed into bone, and the anchylosis is complete.

But it does not theoretically follow, in the absence of facts, that treatment must be unavailing because there is no movement in the joint, even at a period when the lymph presents some traces of osseous deposit. Nor are the experiments of M. Bonnet upon the dead subject conclusive.[2] The organized false membrane, while endowed with vital properties, must tend to yield to a permanent and proportionate force, to be relaxed by gradual traction, and to be absorbed by pressure. In this way, continued mechanical force is capable of producing effects upon the living tissues which the passive resistance of dead and inert fibres would render impossible. In such cases, experiment alone can decide upon the propriety or the efficacy of treatment.

Interarticular adhesions are not the only obstacles to the successful treatment of this deformity. An equal, and according to some writers a greater difficulty, exists in the distortion of the articulating surfaces. Nor is the amount of this distortion indicated by the degree of flexion of which the joint is capable; for, as Duval affirms, the joint may enjoy this power to a considerable extent where the alteration of the articulation is sufficient to interfere materially with treatment. When the luxation is great, and when the condyles are partially absorbed, it sometimes happens that all attempts at extension are fruitless; either because the adhesions are too firm to be overcome, or because

[1] I have examined a knee in this state in which there was no possibility of producing movement, though as yet no osseous particles had been deposited.

[2] In these attempts to straighten the limb it was found necessary, not only to divide the tendons and fibrous tissues, but also to open the joint behind, in order to allow the posterior edge of the articulating surface of the tibia to recede from the femur. *Op. cit.*, p. 563.

the patella has engaged itself between the tibia and femur, and cannot be displaced.[1]

The condition of the articulation also exercises an important influence upon the shape of the limb after treatment. This, however, depends not only upon the degree of luxation and rotation of the tibia, upon the amount of ulceration and absorption of the cartilage and bone, but also upon the direction and adjustment of the mechanical force employed during the treatment.

The tendency of the tibia to backward luxation has been referred to. If in permanent flexion of this sort an extending force be applied to the foot, the head of the tibia does not slide forward on the condyles of the femur, as in the normal condition of the joint, but tends to remain stationary behind it. The anterior margin of its articulating surface forms, against the femur, a fulcrum by which the posterior edge is gradually lifted away from the condyles; so that when the limb is straight, the perpendicular of the tibia is behind that of the femur, and the weight of the body resting on the femur bears upon a point anterior to the head of the tibia.

This is the condition of the leg in a large proportion of the cases mentioned by Duval. Mr. Little seems to have obtained better results, the tibia being made to occupy a position more directly beneath the femur. The advantage in the treatment adopted by the latter surgeon is mainly due to the distribution of force in the machines employed. While that of Duval merely extends the limb, the apparatus used by Little aims both at extension and at the reduction of the head of the tibia, which is pushed into its place by an effort applied directly to it. In fact, without this arrangement, the previously existing luxation is liable to be exaggerated, and even to be rendered complete.

The degree of movement permitted to the joint after reduc-

[1] Phillips, *op. cit.*, p. 201.

tion depends chiefly upon the degree of the lesion, but also partly upon the treatment. In Duval's cases, six patients out of ten were left with a stiff joint; but it should be remembered that this surgeon considers the treatment complete when the limb is brought down and the patient is able to rest his weight upon it. Little, on the contrary, here commences a third stage of treatment, with the view of re-establishing the movements of the articulation, and he seems in some cases to have obtained this desirable result.

When the deformity occurs at an early age, especially when it is congenital, and depends upon muscular contraction, it is of great importance not to delay treatment. The retracted muscles prevent the bones from attaining their normal growth in length, and irremediable deformity is the consequence. In May, 1838, M. Bouvier exhibited to the Académie des Sciences a specimen which demonstrated these consecutive changes of bones and ligaments, and the necessity of early action to anticipate such alterations.

Duval fixes the average duration of treatment at six weeks, and the maximum at three or four months, while Little places the average in adults at two months, a shorter period being necessary for children. The process of restoring mobility requires from three months to a year.

MEDICAL TREATMENT.

It is sometimes well to fortify the general health of the patient, who is often of a scrofulous constitution; and also to reduce, if necessary, the local inflammation, before submitting the limb to surgical influences.

Duval recommends for this purpose a course like the following. Salt-water baths every two days, if practicable in the open air and sun; three or four cups daily of infusion of hops, with ten grains of carbonate of soda, or a dozen pastilles of lactate of iron; claret wine, diluted with infusion

of hops at meals; broiled or roast meat; no milk or fruits. In short, a tonic and anti-scrofulous regimen.

At night, a poultice to the knee made with a narcotic decoction.

Every morning, on removing the poultice, friction of the joint with a bit of the following ointment of the size of a filbert: —

Simple cerate		℥ ii.
Bromide of iron		ʒ ii.
Extract of hemlock	aa	ʒ iii.
Camphor		

For the bromide of iron eight grains of iodine, with a dram of hydriodate of potassa, may be substituted if slight irritation of the surface be desired; or two drams of the iodide of lead, as a simple resolutive producing no cutaneous irritation.

SURGICAL TREATMENT.

Under this head will be successively considered treatment without tenotomy; the section of tendons; sudden extension; gradual extension after the inflammatory symptoms have subsided; tenotomy and extension during the existence of local inflammation.

TREATMENT WITHOUT TENOTOMY.

What has been already said upon this point in connection with Torticollis and Club-foot applies equally to False Anchylosis. The resistance of the muscles, when recently contracted, may undoubtedly be overcome by simple extension. According to Little, we may succeed in effectually straightening the limb without tenotomy in a favorable case of false anchylosis in the adult, even after the lapse of five years; but it is rarely possible in a child, unless of very lax fibre, to relieve permanently by mechanical means a severe

contraction of similar duration. The fibrous transformation is more rapidly effected in children; partly because the functions are in general more active, and partly perhaps because the muscle is subjected to increasing tension as the bones are developed.

THE SECTION OF TENDONS.

The tension of the muscles, and the resistance which they offer to extension, is of course the immediate indication for tenotomy. In the congenital form, tenotomy is especially indicated. When the retraction is only passive and a sequence of permanent flexion, the duration of the lesion will give some indication of the probable degree of fibrous transformation and the propriety of tenotomy. In most chronic cases, extension is facilitated and the treatment is abridged by dividing the tendons of the ham; but the more important element of prognosis, the condition of the articulation, must be taken into the estimate in deciding the question of treatment.

The section of the tendons which oppose the extension of the leg seems to have been first effected by Michaelis.

Dieffenbach operated in 1830, Duval in 1837, Bouvier in 1838, and Guerin in 1839.

The chief varieties in the method of operating are those of Dieffenbach and Bouvier; the former of whom divided the tendons from the deep to the superficial regions, the latter in the inverse direction.

Method of Dieffenbach. — The patient, supported by an aid, is placed upon his knees in a chair, while a second assistant controls the thigh of the affected side. The operator first divides the tendons of the semi-membranosus and semitendinosus in carrying the instrument beneath the skin and beneath the tendons. The biceps is divided in the same way. The extension is then increased to bring into view any

fibres which may still oppose the straightening of the limb, and these are then successively divided. The punctures are carefully closed, and the other requirements of subcutaneous wounds as far as possible fulfilled.

Method of Duval. — The patient lies upon his belly, and the leg is extended. The tenotome is introduced at the level of the tendons and towards their anterior face, the most prominent of which is first to be divided. The leg is then farther extended, and other tendons become in their turn salient. The first is commonly the biceps, the second the semi-tendinosus, then the semi-membranosus.

For the former, the instrument should be introduced from the hollow of the ham outwards, and as far down as possible, to avoid lesion of the vessels and nerves. Two punctures suffice; one for the biceps, and one for the other two muscles. The knife should not be allowed to perforate the opposite surface. It is made to bear directly upon the anterior part of the tendon, which is divided from its deep to its superficial and cutaneous surface. The pain is slight, a few drops of blood only escape, and the punctures heal in two days.

Method of Bouvier. — Longitudinal punctures are made upon the eccentric border of the tendons to be divided. A blunt tenotome is introduced flatwise beneath the skin, while the finger of the left hand of the operator apprises him of the progress of the instrument. It is then turned upon the tendon, which is divided from without inward. The edge of the instrument should be so short as neither to enlarge with its base the external aperture, nor, in dividing the biceps, to wound with its extremity the external popliteal nerve. From the puncture of the outer surface the biceps is divided; from the internal puncture, the semi-tendinosus, semi-membranosus, and, if required, the rectus internus.

According to M. Bonnet, it is necessary in certain cases

to divide not only the rectus internus and sartorius, but the gastrocnemius, which last is effected by severing the tendo Achillis.

From the dissections of this surgeon it appears that the nerves are also sometimes so retracted as to resemble tendons. They may be distinguished, as was before stated, from the tendons, which pass to a point just inside the condyles of the femur, by their position in the centre of the lower part of the popliteal space.

The larger vessels are deeply seated; but the proximity of the popliteal nerve to the outer hamstring is sufficient reason for preferring the method of Dieffenbach, which protects it with the back of the instrument, to that of Bouvier, which exposes it to the edge.

In certain cases, the section of the biceps alone suffices, especially in the variety complicated with inward deviation; but it not unfrequently happens that the semi-tendinosus and semi-membranosus become prominent a week or two afterwards, and require division.

From the internal puncture may be successively divided the semi-membranosus, which is deepest, then the semi-tendinosus, and finally the rectus internus. Resting here, we avoid the section of the internal saphenous nerve, but in dividing the sartorius this nerve and the vein are necessarily comprised in the section.

It is asserted by Little that it is better to divide the superficial and cutaneous nervous filaments which traverse the surface of the gastrocnemius. They may be distinguished from fibrous filaments by the peculiar pain, sometimes severe, occasioned by their tension, especially during treatment.

Professor Froriep of Berlin reports a case in which the fascia lata and fascia cruralis required division. Such cases are comparatively rare.

MECHANICAL TREATMENT OF CHRONIC FALSE ANCHYLOSIS.

Two kinds of mechanical treatment have been applied to false anchylosis: immediate and gradual, or, in other words, violent and progressive.

Among the first are to be ranked the methods of Dieffenbach and Louvrier. The second includes the methods of Duval, Bouvier, and others.

SUDDEN EXTENSION.

The method of Dieffenbach differs from that of Louvrier. While the former divides the tendons and then violently flexes the limb, Louvrier directs the effort to its extension, and without section of the tendons. In the one case, the punctures of the integuments are liable to laceration; in the other, the tendons are almost of necessity ruptured.

Method of Dieffenbach. — Immediately after the division of the resisting tendons and fibres, and also of any deep-seated cicatrices which offer impediment to extension, the operator places one hand upon the thigh of the patient, and with the other seizes the foot and forcibly flexes the limb. It is then alternately flexed and extended, the principal effort bearing upon the flexion. To effect this the united force of two or three men is sometimes requisite.

The rupture of the adhesions is attended with cracking explosions. The punctures, covered during the operation by the fingers of the operator to exclude the air, are now closed with sticking plaster, and the limb enveloped in a roller is placed in a splint.

It sometimes happens that the limb persistently returns to a state of flexion after extension, a movement due to the retraction of the lateral ligaments. The external ligament is commonly the one affected, and is then perceptible beneath the skin, and requires division.

Method of Louvrier. — The barbarous method of M. Louvrier needs but brief notice. The limb is confined in splints hinged at the knee. The patient is placed in a recumbent position, and forcible extension is applied at two points by means of cords wound around a drum. By one the foot is drawn down, while the other simultaneously depresses the knee towards a straight line. Extension is thus effected in twenty-five or thirty seconds; but not without rupture of the skin and of the tendons of the ham, denudation of the vessels and nerves, gangrene, and in one instance suppuration and death on the twenty-second day. In another case the artery was ruptured, gangrene ensued, and amputation was rendered necessary.

The method of Dieffenbach is not exempt from accidents. Duval reports a case of fever, local suppuration, and delirium following the operation.[1]

Such results peremptorily forbid the adoption of these methods in chronic cases, especially as equal advantage is to be derived from a gradual and much less painful application of force.

In recent cases of not more than three or four months standing and the result of acute inflammation, circumstances may render it expedient to break the adhesions by sudden force, but even then gradual extension is to be preferred in a majority of instances. In such an event, when the inflammation has subsided, manual force may be applied as described by Bonnet.

For this purpose, the flexors of the leg are relaxed by a horizontal position of the patient. An aid controls the pelvis, while another supports the foot. The surgeon now with one hand pushes the head of the tibia forward, to counteract its backward luxation, while with the other he depresses the inferior extremity of the femur. The limb,

[1] *Op. cit.*, p. 455.

when reduced, is placed in a hollow splint, and enveloped in a starched bandage.

Slowly Progressive Extension. — In this method, the two portions of the limb are confined in splints, hinged at the knee, and brought into a straight line by long continued traction or other mechanical means. The rectification is often completed in less than a month after the division of the tendons. In exceptional cases it requires three or four months.

In the application of these machines, care should be taken to distribute and equalize the force. It has been elsewhere shown that the tibia is disposed to backward luxation, and often requires to be pressed forward at the moment extension is applied. Perhaps the best machine is that described by Little. The apparatus of Bonnet, which resembles the apparatus of Louvrier, and imitates the manner already described of applying manual force, is also efficient.

The punctures are allowed to cicatrize, and the limb is well protected with cotton before being submitted to the machine. A flannel roller is then applied, somewhat tighter at the knee than above or below, to aid in counteracting the tendency to flexion. Extension at first progresses rapidly, even when the flexion is considerable to the extent of thirty or forty degrees in a week; but is subsequently more gradual and laborious.

When the knee becomes painful and engorged, Duval advises local friction, with the ointment of iodide of lead already mentioned, and compression by means of a flannel roller. The machine is then reapplied. Pain is always an indication for the removal of the apparatus and examination of the limb, as in the treatment of club-foot. When the sections are recent, a slight movement of the limb is apt to occasion great suffering. It should, therefore, be well supported while the apparatus is being changed.

It may sometimes be optional with the patient whether the limb shall be entirely reduced, or whether it shall remain flexed at a slight angle, the latter position being undoubtedly the most convenient, especially in ascending a hill or going up stairs.

Different machines will be found described in the plates. (Figs. 26, 28, 29, 30.)

RESTORATION OF MOBILITY.

After rectification, Little commences a new treatment for the purpose of restoring the mobility of the joint. The method consists of passive movements, frictions, vapor baths, etc., with occasional flexion and extension by means of a machine applied to the leg. This tedious process requires a period varying from three to six, and even twelve months.

MECHANICAL TREATMENT WITH TENOTOMY DURING INFLAMMATION.

In certain cases anchylosis must be considered as a favorable termination of the disease. To interfere with the process would renew the inflammation. Little considers tenotomy inapplicable until two or three years after the termination of active inflammatory symptoms, and cites a case in which disease was reproduced, apparently from a neglect of this rule.

M. Duval maintains an opposite theory, and while he deprecates, in such cases, unaided mechanical treatment, he maintains, in a memoir addressed to the Academy of Sciences in December, 1841, that "club-feet and false angular anchyloses of the knee may be cured during the course of the inflammatory maladies which produced them." The following passage more fully illustrates this point: —

"When there is an inflammation of the knee, the seat of which is shown by the nature of the pain to be in the soft

parts,[1] which is circumscribed or localized, so to speak, in the interior region of the articulation, and the flexion is due to the permanent retraction of the muscles,—when, I say, there is this combination of circumstances, and the inflammation has resisted all common therapeutic means, I believe that everything may be expected from section of the retracted muscles, whatever be the local disorders of the articular parts. By this operation we shall avoid also the chance of anchylosis in a bad position.

"Supported by numerous facts, I believe I may announce the following doctrine. Pain, inflammation, alteration of intra and extra-capsular parts or of the integuments, phlegmonous swelling, œdema, numerous cicatrices, suppurating surfaces, —all these circumstances, which seem to be so many contra-indications, are not to deter the operator, but, on the contrary, should induce him to act. Prejudices which might have previously arrested him must yield to facts."[2]

The tendons being divided, gradual extension is applied to the limb.

This principle is based upon a number of observations, and is supported upon the ground that extension, while it brings into contact new and less diseased parts of the articulating surfaces, separates the posterior and ulcerated portions from each other, and by relaxing the muscles diminishes the pressure of the patella upon the anterior surface of the femur. Extension applied before section of the retracted flexor muscles would evidently counteract these indications by bringing the inflamed surfaces more forcibly together.

M. Guersent, of the Hôpital des Enfans, asserts that in white swelling of the knee it is almost always advantageous

[1] It may be remarked that little indication of the seat of the lesion can be drawn from the character of the pain.

[2] Duval, p. 438.

to practise tenotomy the moment circumstances are tolerably favorable for its performance; that is to say, when the tumor is not extremely painful, and the inflammatory symptoms begin to diminish in intensity.[1]

M. Ribes, a French writer of some note, expresses himself as follows: "Medical art is rich in therapeutic remedies for the relief of white swelling of the knee joint, but in almost all cases, from an obvious cause, they have proved utterly inefficient. This cause is the permanent and forced contraction of the flexor muscles of the leg. *Eh bien!* Why should we not perform, at the proper time, the subcutaneous section of the tendons of the semi-membranosus, semi-tendinosus, and biceps muscles which provoke this uneasy state of things? By this simple operation we may rationally hope not only to relieve the existing pain and distress, but also very materially to promote the formation of anchylosis, and consequently the cure of the disease. This easy and safe operation is already admitted and recognized by surgeons."[2]

It is unnecessary to say that great caution is to be exercised in accepting evidence of this sort, and especially in experimenting upon a lesion sufficiently grave of itself to endanger the life of the patient.

RICKETY KNEES.

This variety of distortion, commonly known as *knock knee* and *bow leg*, accompanies in many cases a rickety diathesis in young subjects. It results in part from the flexibility of the bones. In the former variety the joint also becomes distorted, either from the relaxation of the internal ligament,

[1] Gazette des Hôpitaux, 4 Juillet, 1844.

[2] Medico-Chirurgical Review, October, 1844, p. 469.

or the arrest of development, or shortening of the external lateral ligament. The tibia is then directed obliquely from above downward and from within outward, while the femur forms another side of a triangle of which the summit is the knee. The articulating surfaces of the knee joint become oblique in the line of a perpendicular projected from the summit to the base of this triangle. The extremities of the bones are often enlarged.

Medical Treatment. — In infants, a tonic treatment often suffices to rectify completely the deviation, especially the outward curvature. The following suggestions will give an idea of the treatment of Guerin, in the case of a child of two or three years of age.

Three salt water baths a week, with the addition of one pound of gelatine to each; friction and *massage* morning and evening;[1] every other morning, fasting, a table-spoonful of syrup of gentian alternating with cinchona. For habitual drink, infusion of chicory (slight laxative and bitter) with one third eau de Vichy and one third old Bordeaux. Light but substantial diet; fresh eggs, simple soup; cooked leguminous vegetables and fruit, but neither raw fruit nor milk. Country air. No walking for some months.

The above course of treatment was prescribed by M. Guerin for an infant of two and a half years of age, whose limbs, previously affected with the outward curvature, became straight at the expiration of a few months after its adoption. A simple change of air and diet often produces the same effect.[2]

Surgical Treatment. — When the child has attained the age of six or eight years, the firmness of the external lateral

[1] The term *massage* may be rendered in English by the word *shampooing*. It consists of friction combined with pinching and kneading of the muscles, and with the gentle alternate extension and relaxation of their fibres.

[2] Writer's notes of Guerin's lectures.

ligament in the inward deviation renders it expedient to divide it rather than to attempt its extension. In certain aggravated cases the tendon of the biceps is retracted, and is then to be divided.

M. Guerin does not hesitate to divide the external lateral ligament, thus opening the articulation. He asserts that no ill effect results from this operation, (which I have often seen performed by him,) provided the rules for subcutaneous perforation of the articulations are strictly adhered to.

The section should be made in the position of extension. M. Guerin has endeavored to show that, in certain attitudes of the joints, a sort of vacuum is established in the articular capsules, which promotes the effusion of synovial fluid from the secreting surface by an action of suction. If this be established, it becomes a matter of importance not to divide the capsule when the joint is in such a position as tends to draw into its cavity atmospheric or other surrounding fluids.

Perfect subsequent rest of the limb should be enjoined.

With the consecutive and long continued use of an apparatus, as M. Guerin affirms, the internal portions of the oblique articulating surfaces become absorbed, the leg regains a perpendicular, and the deformity is permanently relieved.

Protracted mechanical treatment is required to produce the essential modification in the joint. Bonnet states that he has never been able to obtain from this method a satisfactory result.[1]

[1] *Op. cit.*, p. 575.

PERMANENT FLEXION OF THE HIP JOINT.

The principles of treatment of false anchylosis of the knee by gradual extension apply equally to permanent flexion of the hip. It is, however, more difficult to appreciate in this lesion the amount of change in the articular structures. The distortion is corrected by mechanical force, either alone or combined with the section of tendons.

A year or two after the cessation of active inflammatory symptoms, gradual reduction may be attempted by the traction of a weight, spring, or other mechanical power. If the tendons resist the effort, the tenotome should be employed.

The tendons which have been divided for this affection are those of the adductor longus and magnus, rectus femoris, sartorius, pectineus, and, lastly, the tendon of the psoas and iliacus. The two last muscles have been divided by M. Guerin, and by Dr. Sargent of Worcester. In the operation of the latter surgeon upon a boy of ten years of age, in whom the deformity, of three years' standing, was the sequence of apparent cerebral affection, the tenotome was introduced about three inches below the anterior superior spinous process of the ilium, and carried in a direction parallel to Poupart's ligament up to the edge of the femoral artery. The tendon being extended, the knife was carried to the bone, when the tension yielded.

Profuse hemorrhage followed the withdrawal of the knife, only arrested by compression sufficient to produce an eschar two inches in length. But the patient, who before the operation was a cripple, confined to his bed or walking upon his hands and knees, recovered in a great measure the use of his limb, and now walks erect without a cane.

It should be mentioned that the puncture was first made

at a point about one inch and a half below the spinous process of the ilium, and above the position of the profunda and recurrent arteries, which would have then escaped division. It proved, however, that the cicatrices of previous sections had condensed the tissues to a degree which rendered them impenetrable by the tenotome, which was therefore reintroduced lower down. The crural nerve was divided. The proximity of the tendon of the psoas to the large vessels will hinder less dexterous surgeons from attempting its division, notwithstanding the eminently satisfactory result of this case.[1]

ANCHYLOSIS.

LITTLE need be said upon this subject. It is rare that a case of simple deformity justifies the surgeon in hazarding the life of the patient to a degree which the operation proposed for anchylosis demands. The integuments and soft parts are widely incised, and the bone, after being exposed, is sawed apart. The patient is left in the condition of a severe compound fracture.

Dr. J. Rhea Barton first performed this operation upon the hip in 1827.[2] The neck of the femur was divided, and a serviceable joint was re-established; which, however, became again anchylosed at the end of six years.

A similar operation was performed by Dr. Barton in May, 1835, upon a knee anchylosed at an angle.[3] The integuments were divided, and a wedge-shaped mass of bone was removed from the femur just above the condyles, the base of which corresponded with the anterior surface of the bone. The limb was gradually straightened, the bone united, and the patient was enabled to walk without a cane.

[1] New England Quarterly Journal of Medicine and Surgery, July, 1842.
[2] North American Medical and Surgical Journal, April, 1827.
[3] American Journal of the Medical Sciences, February, 1838.

The first of these operations was to establish a joint, the second to correct the deformity of the limb.

The latter operation was repeated with success by Professor Gibson in 1841,[1] and the former by Dr. Rodgers[2] in 1843, with like result.

Dieffenbach proposes, in his last treatise, to break down the osseous union of the knee joint with an instrument, and Malgaigne suggests the employment of a chisel and mallet for the same purpose.

LATERAL CURVATURE OF THE SPINE.

The treatment of lateral spinal curvature has received much attention in France, and has recently been discussed at length, and not without warmth, in the Academy of Medicine. The principal advocates of the opposite modes of treatment, are MM. Guerin and Bouvier,[3] the one in-

[1] American Journal of the Medical Sciences, July, 1842.

[2] Ibid., February, 1843.

[3] The following are the conclusions of M. Bouvier: —

That the section of the sacro-lumbalis, longissimus dorsi, spino-transverse muscles, etc., is not immediately followed by diminution of spinal curvature.

The changes which the curves undergo during the succeeding mechanical treatment are exactly identical with the changes produced by this treatment alone, when it has not been preceded by the section of the muscles.

The time necessary to obtain these changes is the same, whether we have recourse to orthopedic means alone, or practise also section of the muscles.

In a word, dorso-lumbar tenotomy has no kind of influence in remedying lateral deviation of the spine, properly so called.

M. Bouvier further concludes that the majority of lateral curvatures of the spine are not owing to muscular contraction; and that the etiology of the distortion, pathological anatomy, and clinical experiments proscribe the section of muscles of the back in the treatment of these curvatures.

sisting upon the necessity of muscular section in certain cases of this distortion, the other maintaining that no advantage is to be derived from it.

The question relates to the duration and efficiency of the mechanical treatment, alone, or accompanied with section of the muscles, and can only be satisfactorily determined by the analysis and comparison of a considerable number of cases subjected to each method. The operation, being attended with little pain or chance of subsequent accident, is hardly to be taken into the estimate if any advantage is to accrue from it. I believe M. Guerin has shown, as far as he is able, that the treatment is abbreviated in certain cases by the division of the muscles. If it is established that these tissues are liable to undergo the fibrous change in the region of the spine as well as of the extremities, as is undoubtedly the case, they must offer a certain amount of resistance to any attempt to extend them. That this resistance is not insurmountable, that the spinal column can be extended in spite of its influence, will be readily conceded by those who have seen the tense and undivided muscles of the ham slowly yielding to the gradual application of mechanical force; but this treatment is often accelerated by the section of the tendons in the popliteal regions, and many are ready to admit that the same advantage is to be obtained by the division of the tense dorsal muscles upon the concave side of an exaggerated spinal curvature.

The two modes of treatment need further investigation; but in rejecting the exclusive views of the partisans of either method, the evidence renders it highly probable that the treatment of lateral curvature is often accelerated by dorsal myotomy.[1]

[1] This subject has been revived in the Académie de Médecine by M. Malgaigne. After a tedious and excited discussion upon the value of dorsal myotomy, the matter was referred to a committee, of which Roux

The pathology of the lesion has been thoroughly reviewed by M. Guerin, whose opportunities have enabled him also to investigate many practical considerations connected with the treatment.

The following is a brief exposition of the views of M. Guerin, with such additions as embrace the more important suggestions of other writers.

CAUSES.

A lateral deviation of the spine presents certain alterations in the conformation, structure, and relative position of the vertebral column and surrounding tissues. The advanced age of the patient, the long duration or the exaggerated degree of this distortion, are conditions which give rise to secondary alterations, and place such deviations beyond the reach of art.

and Velpeau were members. The report of this committee was read to the Academy, November 12, 1844; and may be considered as embodying all that is yet settled upon this point. The following are extracts from this report: —

"Although it should be proved that tenotomy was unavailing in the cases cited by M. Malgaigne, we should have no right to declare, for that reason, that the operation was never efficacious."

"We do not admit that spinal curvatures are unaccompanied with muscular contraction in all subjects."

"But it is important not to deceive ourselves upon the value of tenotomy in such cases; nor yet to decide upon it unless we can establish materially the existence of unyielding or tense cords upon the concave side of the deviation, not merely under the influence of certain active positions, but when we try to straighten the curve by externally applied force."

And among the conclusions: —

"Nothing at present justifies the opinion of those who attribute the majority of lateral curvatures of the spine to convulsive or active retraction of the muscular system.

"But the secondary shortening of certain muscles in the concavity of the curves ought to hinder us from rejecting, *a priori* and absolutely, spinal myotomy."

The question thus stands much as it did before.

Tuberculous and other disease of the bones, anchylosis, and osseous transformation of the fibrous structures, are also conditions foreign to the class of cases about to be described.

Certain forms are eminently adapted to receive aid from an operation, — greater in proportion to the youth of the patient and the inconsiderable degree of distortion. In such cases, the muscles which form the chord of the principal curvature are either primitively or consecutively contracted, and display themselves in certain positions of the body in the form of a resisting fasciculus, which hinders the vertebral column from assuming a normal position. This muscular retraction is identical with that of club-foot and wry-neck.

As a primitive lesion, and a cause of osseous distortion, lateral deviation is *congenital* or *non-congenital.*

CAUSE OF THE CONGENITAL VARIETY.

That the *congenital* variety is due, like other congenital deformity, to muscular spasm, resulting from nervous influence, is shown, —

1. By the frequency with which deviations of the spine and other articular deformities, such as exaggerated distortion of the superior and inferior limbs at their different joints, and also of the hands, feet, etc., coexist in fœtal monstrosities, which offer evident alteration of the brain and spinal marrow. These cases present marked muscular traction in the direction of each deformity, proportioned in degree to the intensity of the lesions of the nervous centres.

2. By congenital deviations of the vertebral column observed in the living subject, and accompanied either with strabismus, club-foot, torticollis, or other distortion of the skeleton, or with appearances of convulsions in the face, irregularity of the two halves of the cranium, or diminution of force and even paralysis in certain parts of the muscular system; or, finally, with veritable congenital spasmodic affec-

tions, such as epilepsy, hemiplegia, paraplegia, with or without muscular contraction.

In the *non-congenital* form, it is equally shown by cases of spinal deviation, dating from a period subsequent to birth and immediately following cerebral or cerebro-spinal affections.

It is accompanied, as in the preceding form, with a great number of other deformities, such as strabismus, torticollis, club-foot, deviations of the knee, all dating from muscular convulsions, and accompanied with retraction of the muscles exactly in relation with the form and degree of these deformities.

In these two varieties, the essential characters of the disease are the same, and identical with those in which the deviation alone remains to indicate the existence of a similar cause at some previous period.

MUSCULAR RETRACTION.

Muscles.—The anatomical characters of the retracted tissues accompanying spinal deviation are the same as those of retracted muscles in other regions.

At first, in a state of spasmodic contraction, they become in a measure paralyzed, their development is arrested, and degeneration commences; fibrous, if they are submitted to traction; fatty, if they remain in a state of repose.

The condition of active contraction differs from that of passive retraction. In the former, the muscle is tense, acts as the immediate cause of the vertebral curve, and limits its extent. In the latter condition, it merely accommodates itself to the distance between the extremities of the curve, and is less forcibly extended.

In both cases the shortened tissue is moderately resisting. In the former or fibrous change, the tissues are felt beneath the skin, as a hard, fasciculated mass, occasionally giving the sensation of fibro-cartilage if the spinal column be extended.

The muscle is found to be diminished in size, retracted, paler, of a whitish yellow, of an eminently fibrous or fibro-fatty texture, contrasting strongly with the regular form, red color, and fleshy consistence of the corresponding normal muscles. The longissimus dorsi is occasionally so fibrous that its aponeurotic and tendinous portion acquires a double length at the expense of the muscular portion.

In the fatty degeneration, the muscle becomes somewhat softer than natural, and retains its original volume.

After the section of muscles thus retracted, the extremities reunite by means of an intervening portion, of adequate length; this tissue regains its normal character, and becomes, in a word, muscle.

Vertebræ. — Upon the convexity of the curvature, both the vertebræ and their intervening fibro-cartilages increase in thickness, while the concavity is marked by a corresponding absorption and diminution of substance of the same parts. They thus acquire individually a wedge shape.

Ligaments. — In cases of long standing or of great deviation, the ligaments may become retracted, and even ossified, in consequence of which the vertebræ tend to become anchylosed.

Thorax. — The ribs follow the deviation of the spine, and in exaggerated examples the thoracic cavity is distorted and compressed, and the contained viscera are modified in position, form, and structure. Portions of the lungs may become indurated, and even acquire a fibro-cellular structure.[1]

The progress of this sort of deviation is chiefly due to mechanical causes. The column once bent is powerfully acted upon by the weight of the body in a vertical position, to a degree which slackens the extended cords, and renders it difficult to detect them beneath the skin. They are not for this reason less efficient in retaining the spine in its abnormal

[1] Difformités du Système Osseux, p. 26.

position; and an upright posture commonly restores their tenseness and indicates their locality. In a young and recent subject this tenseness may be made apparent by suspending the body by the head.

The retraction is sometimes considerable, amounting to a third of the length of the muscle, and is always proportioned to the curvature. In some cases the muscles situated on the convex side of a curvature slip over the spinous processes to occupy a position upon its concavity.

CAUSES OF THE NON-CONGENITAL VARIETY.

Among the causes of the non-congenital form of spinal deviation are: — 1. The convulsions of infancy. 2. Local or general spasmodic action occurring at a later period of life.

These causes, recognized as producing distortion of the limbs and neck, have also their influence upon the muscles of the vertebral column, which is thus suddenly curved, though the resistance of its surrounding tissues may render the deviation so inconsiderable as to prevent its immediate detection. Wounds of the muscles of the back, and blows or other violence to these tissues, may be an immediate cause of their permanent contraction.

Other causes are a want of general muscular and ligamentous force; an inequality in the antagonizing power of opposing muscles, or the paralysis of some of them; an abnormal inclination of the plane of support; an original inequality of the two halves of the skeleton; rickety or scrofulous tendencies; any of which suffice either to create a deviation, or to occasion a predisposition to curvature, which the co-operation of slight causes develops. The superincumbent weight of the body, and the tendency of the muscles to accommodate their length to the distance between the approaching extremities of the arc, augment the curve in proportion to their force, and the inability of the parts to resist their influence.

CURVATURE AND TORSION.

A lateral deviation of the spine consists of two elements, to be separately considered, curvature and torsion.

Curvature is of two kinds. The one occupies the immediate seat of the lesion; the other is an accompanying and compensating deviation. The trunk always tends to maintain an upright position. As soon as a part of the vertebral column deviates from a perpendicular, another portion institutes a curve in an opposite direction by way of restoring to the mass its centre of gravity. For this reason, a single curve never exists alone. It is rare that two are found unaccompanied by a third. Three are very common, and four are occasionally met with.

The position of the spinous processes is not in all cases an indication of the extent or direction of the deviation. In a pathological specimen exhibited to the Academy of Medicine, the column viewed from behind offered a single curve, while the bodies of the vertebræ in front presented four curves. This apparent anomaly is due to torsion, which accompanies all cases of deviation.

The principle of torsion is illustrated by an attempt to bend a blade of grass, or a flat flexible stick, in the direction of its width. The centre immediately rotates upon its longitudinal axis to bend flatwise in the direction of its thickness. In the same way, the spine laterally flexed turns upon its vertical axis to yield in its shortest or antero-posterior diameter.

The centre of rotation or torsion is a vertical line through the summits of the spinous processes, which remain, in consequence, comparatively stationary, while the bodies of the vertebræ rotating around this centre tend to occupy the outside of the convexity. For this reason it often happens that the principal curve alone can be detected by the direc-

tion of its spinous processes, and writers have been thus led to admit the existence of single curvature.

Each vertebra of a curve is laterally bent upon its antero-posterior axis, and the spinous processes are thus inclined towards the transverse processes, upon the convexity of the deviation. The vertebræ at the point of transition from one curve to another are alone to be excepted from this rule.

Other elements of the mechanism of torsion are: —

1. The disposition of the articulating surfaces, which, in the cervical and dorsal regions, are oblique, while in the lumbar region they are nearly transverse.

2. The resistance of the lateral muscles, which become subsequently retracted. Among the principal are the costal insertions of the longissimus dorsi, the inter-spinales, and the inter-transversales muscles and ligaments, which fix the summits of the processes, while the bodies of the vertebræ yield to the effort of flexion.

GIBBOSITY.

To the action of torsion is due the prominence of the ribs, muscles, scapula, and shoulder upon the convex side of the curve, and the corresponding depression upon the concavity. This deformity, commonly termed "gibbosity," is constant in cases of pathological deviation.

CURVES. — THEIR POSITION AND MECHANISM.

It is rare to find two vertebral columns, pathologically distorted, which offer precisely the same characters. Nevertheless certain curves are more frequent than others. A convexity to the right above, and to the left below, is more common than the reverse.

The principal curve commonly occupies the dorsal, or dorso-lumbar region; a circumstance explained by the fact that the centre of the movements of totality, of the vertebral

column, and of lateral flexion in particular, is situated at the point of junction of the dorsal and lumbar regions. This is due to the following anatomical disposition of the articulation, uniting the eleventh and twelfth dorsal vertebræ.

"The articulating facets are more perpendicular and transverse.

"A sort of notch is formed by a prolongation upward and forward of the superior tubercle of the transverse process of the twelfth dorsal vertebra, which is recurved like a hook, so as to convert into a transverse groove the space comprised between this appendix and the superior articulating process of the same vertebra. In this groove is received the inferior edge of the articulating facet of the eleventh dorsal vertebra, which slides there without the least obstacle during the movements of lateral flexion of the column. Besides this circumstance, certain muscles, the quadrati-lumborum, the common mass of the sacro-lumbalis, longissimus dorsi, and semi-spinales, which are the agents of lateral flexion, are to a certain extent circumscribed in this region, and belong especially to it."

A similar conformation, but less marked, exists in the neighboring dorsal vertebræ, which gradually lose this peculiarity in receding from this point, so that the natural curve in the lateral movements of the spine decreases from the loins upward.

A single principal deviation once established, curves of compensation immediately follow, as the result of subsequent active muscular contraction, and the trunk is restored to a perpendicular.

These secondary curves are sometimes hardly appreciable. That occupying the cervical region is often slight, and when masked by the action of torsion is sometimes not indicated by a corresponding curve of the spinous processes. As was before remarked, an existing alternate deviation of the bodies

of the vertebræ of the entire column sometimes presents no appreciable variation from a perpendicular when viewed from behind.

A dorso-lumbar deviation is always arrested in the dorsal region to give place to a curve of compensation. Though more frequent at the junction of the lumbar and dorsal vertebræ, the distortion may occupy any portion of the vertebral column, and is attended with a general prominence of the parts upon its convexity, and a corresponding depression in its concavity.

Exaggerated deviation is accompanied by wrinkles of the skin, corresponding to the concave side of the most considerable curve, often a short distance below the axilla.

The trunk, supported by alternate curves, is very slightly or not at all inclined; the hip is never elevated, it the legs be of equal length, nor does the subject necessarily walk lame.

The *muscles* which are commonly retracted in the principal or dorso-lumbar curvature are the common mass of the sacro-lumbalis and longissimus dorsi; in the central dorsal region, the same mass, with the spinalis and semi-spinalis dorsi; at the cervico-dorsal curve, the complexus, cervicalis ascendens and transversalis colli.

The lesion may occupy other positions. Certain portions of the trapezius may be retracted and fibrous by the side of other portions paralyzed, atrophied, and membranous, and even by the side of healthy muscle. All the muscles of the back are sometimes retracted, producing great distortion. The long dorsal may be alone retracted by the side of the sacro-lumbalis passively affected, or a simple fasciculus of one of these muscles may offer a state of tension in the midst of healthy tissues. In such cases it is amply proved that the extended muscular bands, when subjected to torsion, may become retracted; in other words, their development is

arrested; they are in a measure paralyzed, and more or less transformed into fibrous tissue. In such conditions they fulfil, with regard to the spine, the functions of a string in a bent bow.

TREATMENT.

Distortion of the spine is less amenable to treatment than other deformity; chiefly, perhaps, from the difficulty of applying to it a permanent and properly directed mechanical force. A first difficulty presents itself in the necessity of flexing the entire body, in order to affect corresponding flexion of the vertebræ. The trunk is unwieldy, and a lateral force can be applied only through the intervention of the ribs, shoulders, or pelvis. Nor can it be maintained for a length of time. The respiration is impeded, the posture is constrained, the integuments are irritable, and the subject impatient of confinement. The mechanical treatment must therefore be frequently suspended, and in these intervals various influences, among which the vertical weight of the trunk is not the least, tend to reproduce the deformity. The subsequent exercise of the muscles, so important in orthopedic treatment, can only be accomplished in the region of the spine by exaggerated and comparatively fatiguing movements of the whole body.

It is obvious that such conditions are far less promising than those which commonly attend the treatment of club-foot, where the whole distortion is embraced by the apparatus, which maintains an unremitting and progressive force as long as it may be required, and where the gentle exercise of walking subsequently secures the advantage obtained from the use of a machine.

The results of the treatment of spinal curvatures are, as might be expected, much less satisfactory than those of most other distortions, while the time required is longer; and

hence the difficulty of deciding between the claims of different methods.

The deformity is often inconsiderable and stationary, and requires no treatment.

At other times the constitution of the patient requires to be fortified by change of air, food, salt baths, cold douche, frictions, and *massage.* Exercise in the open air is important, and the mechanical treatment of this deformity is always combined with gymnastic exercises. These should be so contrived as to strengthen the muscles upon the convexity of the principal curve, and to elongate those upon its concavity. Such are climbing the under side of a spiral ladder, turning a crank above the head and on the side of the concavity in a horizontal position, a lateral rocking-horse inclined towards the side of the concavity. These will serve as examples of a great variety of contrivances obvious to a mechanician.

A bag of sand or shot, carried upon the head while the patient walks, is an excellent method of exercising the dorsal muscles.[1] But when the patient is at rest, its vertical weight would obviously tend to exaggerate the curvatures.

If, however, in certain postures of the patient, a tense fasciculus appears beneath the skin upon the concave side of the principal curvature in the position of a chord uniting the two extremities of the arc, there is little doubt that the progress of mechanical treatment will be accelerated by its subcutaneous division. Even were the section of muscles unnecessary, the operation is attended with no danger and with little pain or hemorrhage. It offers no impediment to subsequent mechanical treatment, which is the same in every respect except in its duration, whether the muscles be severed or not.

[1] The straight backs of negroes, and of people accustomed to carry weights upon their head, are proverbial.

SURGICAL TREATMENT.

In a case such as that just mentioned the exact position of the retracted fasciculus is ascertained by placing the patient in a vertical or horizontal position, or by making extension, if requisite. Parallel extension is sometimes used to effect an elongation of the muscles preparatory to their section.

OPERATION.

M. Guerin nowhere indicates the manual of the operation. In those I have seen performed by him, amounting to a dozen or more, the patient was laid upon his belly upon the table. The hands being extended by the side, the patient was desired to raise his head, an action by which the dorsal muscles were brought into play and their retracted fibres made tense. A fold of skin was then pinched up at the outer edge of the extended fasciculus, and, a puncture being made, the myotome was introduced flatwise at the base of the fold, at a point which afterward receded to the distance of an inch from the external border of the muscle. The knife being then turned upon the mass, the fibres were divided by a sawing motion communicated to the convex edge of the blade.

By reason of its fibrous character, the resisting cord is divided with precision and at once; and its complete section is attended with a sharp and distinct snap, as the extremities recede one from another. On the other hand, non-retracted muscular fibres are soft, and yield before the instrument, which is unable to effect either a clean or a rapid division of their substance.

Immediately after the operation, certain elements of the deformity disappear at once, and other fibres rise to take the place of those which have been severed. They often occupy nearly the same position, and their section is attended with an additional correction of the deviation.

A similar occurrence sometimes takes place at the end of six or eight months after the commencement of mechanical treatment. When the curvature remains undiminished during several months, the redivision of the muscles is attended with a new diminution of the curve,—generally rapid during the first days following the operation.

MECHANICAL TREATMENT.

Mechanical treatment is effected either by portable apparatus, which allows the patient to move about, or by mechanical beds, in which force is applied horizontally.

In the former, a broad metallic belt embraces the hips, and serves as a fixed point, from which extension is applied either to the head or more commonly to the shoulders. The inconvenience of the latter method is apparent. The shoulders and scapula yield to the force, while the vertebral column is unaffected by it.

The Apparatus of Hossard, modified by Tavernier, does not aim at extension. It consists of a belt of wadded leather, four or five inches broad, and fixed around the pelvis by horizontal and perineal straps. Behind, a steel upright reaches to the height of the shoulders, and is attached to the belt by ratchet-work, which admits of its lateral inclination towards the shoulder of the concave side of the curve. From its summit a broad strap winds spirally downward round the convexity of the curve, which it presses towards a perpendicular, and is fixed to the belt in front. The trunk, being thus thrust from its centre of gravity, tends in recovering itself to correct the spinal deviation.

The strap should traverse the most salient point of the ribs behind, while a second strap passes, if required, in the contrary direction around the lumbar curve. This efficient apparatus does not forbid active exercise. Its great advantage is, that the correcting force is purely muscular, and

derived from the efforts of the body to regain the perpendicular from which it is thrust by the machine. Shoulder supports, and the "Minerva" already described[1] which exercises traction upon the head, being substitutes for muscular action, only enfeeble this function in their effort to supply its place.

Marshall Hall proposes to take a plaster cast of the body, in an upright position, and to deposit upon it by the galvano-plastic method a coating of copper. The whole is sawed in two vertically, and a pair of copper corsets are thus produced exactly fitted to the trunk.[2] The idea is ingenious, but the principle of support is open to the objection just mentioned.

Various orthopedic beds have been devised for the purpose of effecting horizontal extension. In these the force is best applied in a direction parallel to that of the spine, or in a direction perpendicular to it.

PARALLEL EXTENSION.

Parallel Extension is effected by fixing the pelvis and applying an extending power to a series of straps passed round the chin and head. This is best effected by a machine about to be described.

The method of parallel extension is applicable in old and very pronounced curvatures, where the extent of the curve gives power or purchase to simple traction. Also in the deviations with four curves, or where one closely follows another in the dorsal region. It is then impossible to apply perpendicular force to each curve separately, on account of their proximity. Continued force of this sort is liable to produce a relaxation of the ligaments, which predisposes the spine to a recurrence of the deformity. It also tends to efface the natural antero-posterior curves. Many young

[1] See page 95, and Fig. 24. [2] Lancet, February 3, 1844.

people treated in establishments where orthopedic beds are exclusively employed, have their backs flattened, the shoulders and other regions of the vertebral column being reduced to the same plane. These ill effects are to be combated by suitable gymnastic exercise alternating with extension. Horizontal extension also acts but indirectly upon the wedge-shaped conformation of the vertebræ, its power diminishing as the curve becomes less marked.

SIGMOID EXTENSION.

The method which Guerin has called *sigmoid extension* consists of several elements.

The first of these is parallel extension, the head and pelvis being respectively attached to the top and bottom of the bed.

The second is a lateral force applied to a point upon the side of the trunk corresponding to the convexity of the curve, and in a direction perpendicular to it. The action is analogous to that of straightening a bow, when the extremities are held in the hands, and the knee is applied at an intermediate point of the convexity. It has several advantages over ordinary parallel extension. The power is applied to greater advantage, and a temporary curve in the opposite direction is substituted for the original curve, as in the attempt to straighten a bow.

This feature of sigmoid extension is of great importance. To effect it, two uprights are placed upon opposite sides of the bed, one above the other, at points which correspond with the convexity of each curve, and are capable of being advanced towards a median line and fixed in that position. This simultaneous application of the power to the extremities and convexity of the double curve, or S, suggested the term *sigmoid* extension. It is the more efficient, as many deviations have their principal curve at the level of the dorso-lumbar region, which answers to the articulation already

described of the eleventh and twelfth dorsal vertebræ, a coincidence which greatly aids the action of the machine.

A third peculiarity is the combination of flexion and extension. It is effected by placing the centres of rotation of the upper and lower portions of the bed upon opposite sides. In illustration of this, provide a strip of board and a pair of compasses, the length of which is equal to the width of the board. Saw the board across, and placing the shut compasses horizontally in the interval of division, attach a leg to each of the sawed surfaces. The joint of the compasses forms a lateral centre of rotation for the boards, and, in flexing one board upon the other, the triangular interval of separation gradually increases. If the board be again sawed and provided with a similar joint upon the opposite side, this arrangement will represent the orthopedic bed employed by M. Guerin, in which a joint corresponds to each of the two principal curves. The body of the patient fixed upon it is at once flexed by the joints, and extended by the increasing intervals of separation.

A helmet is united to the apparatus by a universal joint, and serves for the mechanical treatment of torticollis. It is capable of being fixed in any position which the cervical vertebræ in their normal state are capable of assuming, and acts as a point of counter extension to the pelvis, which is attached by a belt and straps to the foot of the bed. It should be remarked that the extension of the head is in reality effected, not by the helmet, but by a stuffed collar of iron suspended from its lower margin.

M. Guerin finds it inexpedient to flex simultaneously the upper and lower segments of the bed; and when there are two principal curvatures of nearly the same degree, they are treated alternately in different parts of the day.

When there is a single principal curve for which the muscles have been divided, M. Guerin directs attention to this,

to the exclusion of the less marked curves of compensation. In such a case, the body, being extended, is thrust to the side of its concavity by the aid of the uprights alone, one of which is applied to the convex point, while the opposite antagonizes the pelvis. The two portions of the bed are then not flexed.

In certain scrofulous and other deviations unattended by muscular contraction, simple flexion may be required, without extension. It is effected by a bed like that described, but possessing but one division, with its axis of lateral flexion at a point equidistant from the two sides.

The apparatus will be better understood by referring to Figures 31, 32, 33, and 34.

CONTRACTION OF THE HAND AND FINGERS.

The section of tendons in the hand is much less uniformly productive of good results than in many other regions, and its propriety has been disputed. The indications for the operation are not yet clearly pointed out. It has been performed by most orthopedic surgeons, but it is doubtful if it is ever efficacious, while it is certain that the fingers are sometimes disabled by the operation.

CAUSES.

The distortion is sometimes due to diseases of the bone. That form which is owing to a contraction of the tendons, or which is accompanied by this symptom, recognizes a variety of exciting causes. It is occasionally, but rarely, congenital. It results from cutaneous eruptions, fractures, wounds, or abscesses. It also follows paralysis of antagonizing muscles. In the variety thus accompanied by active or

passive muscular retraction, which alone offers conditions for tendinous section, the tendons are resisting and in high relief beneath the skin.

The deformity is rarely due to a single set of muscles, and it commonly represents a combination of the various movements of the hand. Flexion of the hand is sometimes accompanied with extension of the fingers or with a lateral inclination, and with flexion of the phalanges. The muscles of the arm not unfrequently participate in the affection, and the forearm is more or less flexed or pronated.

It has been demonstrated by Froriep, of Berlin, that the palmar aponeurosis, when retracted, may aid in the flexion of the phalanges by means of fibres which it supplies to each side of the fingers. In certain cases the joints are partially anchylosed, and require forcible extension.

The section of the flexor tendons of the fingers is frequently, if not in all cases, followed by a loss of power in the hand. The phalanges can no longer be flexed. It has therefore been a question whether their division should ever be attempted. In support of the affirmative, it is urged that the deformity is in a great measure relieved, and that in unsuccessful cases the hand yet retains sufficient power to grasp large objects. But it is probable that, were the chances fairly represented, few patients would consider the shape of a hand an inducement to hazard the loss of its use; and the histories of cases like that of M. Doubouvitski [1] will

[1] In this well known case, many tendons of the forearm and hand were divided by M. Guerin, among them the deep flexor in the fingers and the superficial flexor tendons in the forearm. The patient, who before was able to retain an object in the contracted fingers, lost all power of flexing the phalanges, and the hand became in consequence comparatively useless.

Similar instances are not wanting. The case of Jenny Wilson, reported by M. Guerin to the Académie des Sciences to illustrate the innocuity of the division of thirteen tendons, was examined by M. Phillips, a year

deter most surgeons from attempting the division of the tendons in this region.

OPERATION.

For the deviation of the entire hand, which is rare, it suffices to divide the palmaris longus and brevis, and perhaps the flexor carpi ulnaris if there be a lateral inclination of the hand. These tendons are subcutaneous, and easily divided. The motions are generally restored when the contraction is not due to paralytic affection of the antagonizing muscles.[1] More commonly the flexors of the fingers are also retracted and the phalanges drawn toward the palm. The first phalanx often remains straight, while the last two are flexed upon it.

After dividing the flexors in the forearm, the hand may be more or less extended; but when, as it often happens, the fingers are stiff and unyielding, the surgeon is required to decide upon the expediency of additional sections in the palm and fingers. In such a case, extension may be sometimes effected by force, but it should be previously ascertained that the resistance is not due to the retraction of tendons or palmar aponeurosis.

As was before stated, the division of the tendons of the palm and fingers is rarely successful. The section of the

afterwards at the Salpêtrière. He sums up the anatomical details as follows: "This patient remained during nine months in the service of M. Guerin at the Hôpital des Enfants. She bitterly deplores, as well as her mother, the results of all the operations she has undergone. Before these sections she could make a movement with the fingers which permitted her to hold a needle, which she then seized with the mouth to be again taken by the fingers. By these movements she could sew fast enough to make shirts. Now this sole resource no longer remains; she is condemned to vegetate in a ward of incurables at the Hospice de la Salpêtrière. The thirteen sections were made in the forearm, in the two legs, and two feet." — Annales de Chirurgie, Paris, 1841, tom. ii. p. 130.

[1] Little, in Lancet, December 16, 1843.

deep flexors at the level of the second phalanges allows the extension of the fingers, but paralyzes their power of flexion. The tendon is drawn back through the bifurcation of the superficial flexor, and an interval is thus formed between the divided surfaces, which are hindered from uniting by the presence of the synovial fluid.

In the present state of knowledge upon this subject, it may be affirmed that the superficial flexors of the fingers should never be divided at the base of the first phalanx, but rather in the forearm. The proximity of the median nerve at the wrist compels us to divide the deep-seated flexors in the palm, if at all; but the reunion of their tendons is uncertain. The operation is indicated only when a single finger is permanently flexed, and interferes with the movements of the others.

The flexors of the toes are sometimes retracted, and may be divided in the sole, the re-establishment of motion being here of comparatively little importance.

Little benefit is obtained in most cases from a simple division of the cicatrices consequent upon burns, especially upon the palmar surface.

MECHANICAL TREATMENT.

Immediately after the section the patient is apt to experience severe and deep-seated dragging pain in the arms, due to the forcible contraction of the muscles. The pain is alleviated by frictions and steaming.

The hand, being well protected, is confined in contact with a straight splint, extending from the elbow to the extremities of the fingers. The splint may be provided at the wrist with a hinge regulated by a screw or other mechanism, so contrived as to fix it at any required angle. The whole may be supported in a sling.

CONGENITAL DISLOCATIONS.

Numerous well described cases of the different varieties of congenital luxation are to be found in the papers of various writers, especially since the subject has received general attention. Although interesting, in an anatomical and pathological point of view, they are generally to be referred to the principles laid down by Guerin in his memoir upon this subject, which is the groundwork of this section.

CAUSES.

Certain forms of congenital dislocation are due to the paralysis of muscles.

Luxation resulting from disease of the bone is unaccompanied with active muscular retraction, and is easily distinguished.

The affection is due in a large majority of cases to muscular retraction, and resembles in this respect club-foot and wry-neck. It accompanies these distortions, and like them is found in acephalous fœtuses and in other abnormal conformations of the nervous system.

LOCALITY AND PROGRESS.

Any joint in the body is liable to congenital dislocation from muscular retraction.

The luxation may be partial or complete. At an early period of fœtal life the articulating cavities are imperfectly formed, and the articular extremities easily extend the yielding ligaments, and escape from their normal positions. At a later period, when the sockets are more completely developed, the dislocation is commonly partial.

The progress of the luxation is due to the arrest of the

development of certain muscles; to the physiological contraction of others; and to the superincumbent weight of the body. These forces eventually make a dislocation complete which was at birth only partial. In such cases, an indeterminate length of time is required to complete the luxations. The femur rarely escapes from the acetabulum in less than three or four years after birth; and surgeons have been thus led to suppose the affection non-congenital.

An essential step towards the reduction of the dislocation is the division of the retracted muscles, whether actively or passively affected.

CONDITION OF THE MUSCLES AND SOFT PARTS.

The muscles originally concerned in inducing the luxation are actively retracted. Others, passively retracted, merely accommodate themselves to the approximated points of insertion. Their direction is often changed.

Their texture is either fibrous when tense, fatty when exempt from traction, or hypertrophied when tasked with the duties of muscles no longer efficient.

Muscles primarily retracted require division. Those passively shortened may be, in certain cases, mechanically extended, but sometimes require division. The fatty tissue opposes no obstacle to the normal position of the part.

The arteries become flexuous, and retain their length, but decrease considerably in volume.

The veins increase in number and in size.

The nerves are shortened, probably through the agency of their fibrous sheath; and their mechanical extension during treatment is attended with pain.

The cellular tissue increases in quantity, fills up depressions, and takes the place of the atrophied muscular fibre.

The skin adapts itself to the conformation of the subjacent parts, being often cushioned in depressions by adipose matter.

The ligaments and capsules, like the muscles, are changed in form, dimensions, and texture. They may be actively retracted as well in congenital dislocation as in other deformity. In extreme adduction of the foot, the internal lateral ligament of the tibio-tarsal articulation and the astragalo-scaphoidean ligament are sometimes reduced to a third or a quarter of their normal length. In the same way the external lateral ligament of the knee offers an obstacle to the correction of internal deviation of this joint. The ligaments are also subject to passive retraction, merely accommodating themselves to their approximated points of insertion.

When extended, they become thinner and longer. Like the muscles, they are subject to fatty transformation when in a state of continuous repose, though to a less degree. Under circumstances which produce fibrous transformation of the muscles, the ligaments tend to become ossified, a condition which is also the occasional effect of rest alone.

The articular capsule of the femur, when extended gradually, acquires the form of a double cone united at its apices.

In fine, the ligaments and capsules, when retracted, offer invincible obstacles to reduction by unaided mechanical force; and when elongated, they constitute a serious impediment to any efforts in maintaining reduction.

The cavity of the capsular ligament of the head of the femur, has been found to be obliterated in old subjects, a fact upon which has been founded an argument against attempts at reduction. This condition does not prevail in young subjects, and is rarely a serious obstacle to reduction until the patient attains the age of twelve or fourteen years. The continuity has been found to exist even in subjects of twenty, twenty-five, or thirty years of age.

Alterations of the Articular Extremities. — The head of the femur, for example, is diminished in size, while its neck

becomes shorter and more horizontal. It may be flattened or grooved by pressure against the edge of the socket or other neighboring parts.

When no longer lubricated by the synovial fluid, its surface loses its polish, and becomes rough, while the cartilage gives place to bone.

Articular Cavities. — The cotyloid cavity is especially the seat of alteration. It tends to become both superficial and triangular, in a fashion corresponding to the triple formation of the os innominatum.

The articular cavities are obliterated in proportion to their original depth and the date of the lesion. This is effected: — 1. By a rising up of the bottom of the socket, which seems to result from the absence of pressure. 2. From the production of a cellular fatty tissue, apparently due to hypertrophy and degeneration of the normal tissues of the base of the cavity.

When the luxation is partial, the cavity yields before the continued pressure of the head of the bone in the direction of the force which it exerts.

These conditions may be thus summed up, with reference to the reducibility of the luxation.

When the head of the bone has escaped from its socket, and no new socket has been formed, both the articular extremity and cavity proportionately diminish in size. This circumstance, while it facilitates reduction, impedes subsequent movement. The reduction, however, tends to induce the parts to resume their normal size. If the head of the bone has formed a new socket, it retains nearly its original dimensions, a condition which hinders it from entering the atrophied socket and prevents reduction.

The grooves and other irregularities in the conformation of the articulating extremity interfere both with reduction and subsequent movement.

After reduction, the articular deformities and the relaxation of the capsules facilitate the recurrence of luxation.

The change both of bones and soft parts is gradual and slow, so that, although these luxations are not at first irreducible, they become so after a time. Guerin has reduced congenital dislocation of the femur of ten years' standing, and M. Guillard has reported a similar case of permanent reduction of a scapulo-humeral luxation in a girl sixteen years of age.

Congenital dislocation is not due to a simple arrest of development of the bony structure. If the bones be examined at an early period after luxation, they are found unchanged.

ALTERATIONS OF PARTS IN THE NEIGHBORHOOD OF LUXATIONS.

New articular cavities are sometimes formed, and sometimes not. They are rarely developed before the age of twelve or fourteen, but the period of their formation varies. In an old woman of seventy-three, with double congenital luxation of the hip, one new cavity was formed, while the other side presented merely a slight depression.

With regard to the conditions which aid in establishing the new socket, M. Guerin declares it to be a law that such cavities are formed only when the capsular ligament is ruptured and the head of the bone is placed in contact with the bone upon which it lies.

When the new joint is formed, the ruptured capsule contracts firm adhesions, which preclude all chance of displacing the bones, except by unjustifiable violence.

When there is no new joint, the head of the bone is finally bound down by fibrous cords, which require subcutaneous division.

Alterations of the Skeleton. — These are especially observed near the hip. Contrary to the opinion of Dupuytren, the

pelvis often suffers in these cases, as has been shown by M. Sedillot.

When one femur is luxated upward and outward, the pelvis of that side is carried upward, backward, and outward. The whole pelvis is flattened obliquely, the pubes being carried beyond the median line towards the healthy side.

The os innominatum of the affected side becomes more perpendicular, and that side of the pelvis is elevated.

INDICATIONS FOR REDUCTION.

From examinations of the pathological conformation of the parts in different stages of lesion, it results that congenital luxations are reducible in certain conditions; that they are less so in proportion to the degree and long standing of the deformity; that they are wholly irreducible when very old, and principally when accompanied with new articular cavities; and, finally, that the permanence of the reduction is in proportion to its facility.

MEANS OF PREPARING FOR, EFFECTING, AND CONSOLIDATING REDUCTION IN ALL ARTICULATIONS.

Preparatory and continued extension, which counteracts the displacement due to superincumbent weight, and brings into view the retracted muscles.

The subcutaneous section of muscles which refuse to yield to extension.

Continued extension of the ligaments, and their subcutaneous section if required.

The reduction of the luxation.

The consecutive treatment, of which the indications are: —

Apparatus of extension to elongate the muscles and ligaments not divided, and to extend those which have been divided.

Force so applied as to maintain the articular surfaces in contact, and to exercise continued pressure upon the part destined to form a new socket.

Gradual motion in imitation of the normal movement of the part, to wear away as it were a depression for the articulations, and to establish its functions.

An indication derived from the fact that the capsule must be ruptured, and the bones placed in contact before a new articulation can be established.

M. Guerin therefore practices subcutaneous perforation of the capsule, and scarification of the ligaments, to promote an inflammatory action, which may induce their firm adhesion.

In this way M. Guerin reduced a congenital dislocation of the sternal extremity of the clavicle in a girl thirteen years of age, which had been many times attempted without success. He scarified the capsular ligament, and repeated the operation at the end of ten days. The extremity of the bone was confined in its place, and in a month the ligaments were firmly retracted, and the arm was capable of executing its normal movements without a renewal of the luxation.

RECENT AND CHRONIC DISLOCATIONS.

The tendons not unfrequently form a serious impediment to the reduction of accidental dislocations of long standing, especially of the humerus and olecranon. They have been not unfrequently divided in these cases by the subcutaneous operation, and the limb has been thus replaced with comparative ease.

The pectoralis major, latissimus dorsi, and teres major

and minor muscles, have been thus divided for the purpose of reducing a dislocation of the shoulder of long standing.

I have seen M. Bérard divide the tendo Achillis for the purpose of facilitating the reduction of a recently dislocated foot, which was thus easily replaced, and the patient subsequently recovered its use. Several similar cases are reported in the journals by this surgeon, and by other writers.

In the reduction of a dislocation of the foot, of long standing, accompanied with the formation of an artificial tibio-tarsal joint, M. Bonnet divided the tibialis posticus, the extensors of the toe and of the great toe, and finally all the fibrous tissue of new formation.

SECTION OF MUSCLES IN LOCKED JAW.

Certain rare forms of this affection are due to bony anchylosis, for which M. Bérard has proposed a section near the condyles analogous to that practised in Barton's operation for anchylosed hip.

The more common form results from muscular contraction. For such cases M. Bonnet[1] proposes the section of the masseter and temporal muscles, as an aid to ordinary mechanical means for separating the teeth. The masseter is best divided, according to Bonnet, in its superior fifth. Below this point it adheres to the lower jaw and is covered behind by the parotid gland. The tenotome is entered at the anterior border of the muscle just below the zygomatic

[1] M. Bonnet effected the division of the masseter muscle on October 16, 1841. It had been performed by Dr. Schmidt of New York on the 8th of the same month. See Boston Medical and Surgical Journal, July, 1842.

arch, and carried behind it as far as the coronoid process of the lower jaw. The muscle is then divided from within outward.

The temporal muscle may be divided above or below the arch. It is best divided below, unless, as in old patients, the coronoid process is so long as to impede the progress of the knife. The muscle may be always divided above the arch, but its substance is less tendinous, and the hemorrhage from the deep-seated temporal artery is considerable.

In the section beneath the zygomatic arch, the tenotome is entered at nearly the same point as for the section of the masseter, and directed towards the tuberosity of the superior maxillary. The blade is then passed backwards, between the external pterygoid and the temporal muscles, until it reaches the articulation, when the muscle is divided from within outwards. The coronoid process is occasionally an insurmountable obstacle to the section in this region.

Above the malar bone the blade is entered just in front of the temporal artery and carried to the bone, in contact with which it remains until it reaches the posterior part of the malar bone. The edge is then turned outward, and the muscle divided. Both the muscles may be simultaneously divided.

In one case in which M. Bonnet applied these methods, a slight amelioration was obtained. The patient was old, and the affection of long standing.

The operation of Dr. Schmidt was followed by immediate relief in a case of locked jaw of twelve years' standing.

SUBCUTANEOUS SECTION OF THE ORBICULAR MUSCLES.

THESE muscles have been subcutaneously divided, with good results, for various affections; that of the mouth for deviation of one of the angles, which after operation assumed its normal position;[1] that of the eye, by Cunier, for ectropion; the sphincter of the anus, by Blandin, Brachet, and others, in cases of fissure of the anus.

M. Phillips affirms that the orbicular muscles are not formed of circular, but of straight fibres, obliquely disposed, and attached by one extremity to a median line, and by the other to an aponeurotic circle which surrounds them.

This he infers from the irregular form of the mouth in the spasmodic action of its orbicular muscle, and from the fact that, in drawing upon the fibres in any direction, the orifice is distorted, and a chord instead of an arc is produced by the traction.

The relief obtained by the division of the orbicular muscle of the eye, in the case of ectropion operated on by M. Cunier, and above referred to, seems to confirm this theory.

[1] Phillips, Ténotomie Souscutanée, p. 204.

APPENDIX.

In the treatment of deformity, it is common at the outset to take a cast in plaster of the distorted region, which may be afterwards compared with a cast taken at a subsequent time. The result of orthopedic treatment is in this way readily appreciated.

In casting entire limbs some little dexterity is requisite. The tendency of the dried or anhydrous sulphate of lime to set, or form a solid hydrate when mixed with water, is well known, and most people are familiar with the general features of the process of casting in plaster. But there are some details connected with manipulation in casting large masses, and in taking moulds from the living subject, which deserve to be mentioned. I have therefore written out the following description of the process, most of which I obtained from the *mouleur* attached to M. Guerin's establishment.

No tools are a substitute for the hand, which is in contact with the plaster during the whole process. The only utensils required are a stiff spatula of wood, or better of iron, a bowl, and a chisel and mallet.

The necessary quantity of plaster must be mixed at once. It is evidently better to exceed than to fall short of the required amount.

The most convenient vessel is a basin or common earthen pan with flaring sides. Into this water at the temperature of about one hundred degrees is first poured.[1] The calcined plaster is then taken in large handfuls, supported by the open palm and fingers which are slightly separated, and gradually sprinkled into the water by a sort of undulating movement of the fingers. In this manner the water attacks each particle as it falls, and hinders the formation of lumps, which it is afterwards difficult to break up. The powder is thus continuously added until it is so heaped up that it begins to appear above the surface. Half a minute is allowed to elapse to enable the water to penetrate it thoroughly, after which the mass is stirred with the spatula

[1] Cold water subjects the patient to unnecessary exposure.

until it assumes, at the end of a minute, a uniform consistence of the density of thick syrup. It is then ready for use.

The plaster is placed in contact with the object, of which a cast is desired, and when hard is removed. It then constitutes a mould into which a fresh quantity of plaster is subsequently poured. The last should present when withdrawn, a fac-simile of the original.

It is evident that solid objects require a mould of several pieces, which multiply in proportion to the complicated form and unyielding material of the model. Flesh and other soft tissues yield to the projecting angles of the mould, and the number of its pieces is thus considerably diminished. It is rare that a human limb or trunk requires a mould of more than two pieces.

The divisions are made by means of a strong thread, which is applied to the limb before the plaster is laid on, and, being withdrawn by its loose ends when the plaster is half hardened, it cuts its way out and bisects the mould. The position of the string as a general rule is as follows.

On the leg, from the superior insertion of the rectus muscle, over the patella, along the tibia to the outer side of the great toe, and by the centre of the sole, heel, and ham, to the tuberosity of the ischium. A better division is from the great trochanter to the head of the fibula; thence to the centre of the external malleolus, and along the external edge of the foot to the edge of the little toe and the end of the great toe; then back to the internal malleolus, the internal condyle of the femur, and the superior insertion of the adductor muscles.

The arm is divided by a line from the insertion of the pectoral muscle to the styloid process of the pronated radius, and by the radial edge of the hand and the tips of the fingers to the styloid and coronoid process of the ulna and the region of the deltoid. If the fingers be separated, the string is to be carefully carried to the base of each, upon the edge which separates the palmar and dorsal surfaces.

Upon the trunk, the line passes over the back of the neck a little before one shoulder to the great trochanter on one side, and behind the other shoulder to a point just behind the trochanter of the opposite side.

The action of respiration commonly breaks the mould upon the anterior surface of the trunk, and the pieces are to be subsequently put together.

The mould of the head requires but two pieces, separated before and behind on the median line, or, which is better, by a line over the vertex, passing before one ear and behind the other. Such an oblique division obviates the difficulty presented by corresponding prominences on opposite sides of the original. They are thus distributed between the two halves of the mould. The hair is covered by an oiled napkin and the ears are plugged with cotton.

The head is commonly included in a cast of the neck; a perpendicular position is necessary. The soft plaster then flows off from the sides of the nose without obstructing respiration. In the horizontal position, quills or paper tubes are placed in the nostrils.

A perpendicular position is required to display the action of the muscles of the neck or trunk, while the limbs may be cast horizontally. When permanently flexed, the plaster is kept in contact with their inferior surface by a sort of bed formed by a sheet of stiff paper supported by straw.

As a slight motion breaks the plaster before it is hardened, young children require to be confined during the process.

If a leg, for example, is to be cast, the plaster is prepared as before indicated; some of the thinner plaster is then applied with the hand to the external and internal surfaces of the limb, and by means of this the string is made to adhere, care being taken to bring it in contact with the skin at every point. The limb is then gradually covered, and the plaster as it thickens is applied with the hand till it attains a depth of from one to three inches. The string is withdrawn while the plaster is yet soft, and the mould thus divided is allowed to harden. The mass grows warm, and it is just before its maximum heat, when a fragment pressed between the thumb and finger breaks as if dry and brittle, that it is to be taken off. If the plaster by accident becomes too hard, so that the string breaks, the mould is to be broken with a chisel and mallet, and the fragments are subsequently united by a layer of plaster applied to the outside.

In casting the back, the model is seated upon a table, and, the

hairs of the neck being matted together with soft soap, the plaster is applied with the hand to the upper part of the neck and shoulders, and allowed to stream down the back. As it attains consistence it adheres to the skin and may be built up.

The interior surface of the mould thus formed is immediately painted over with a mixture of soft soap and water, and when saturated the superfluous soap is removed and a thin coat of oil applied. If composed of pieces, these are united and the mould is then ready for the cast. Plaster is prepared as before, poured into the interior without delay, and allowed to set.

At the expiration of fifteen minutes the mould must be broken off in small fragments with a chisel and mallet, and is hence said to be lost (*stampa persa*). During this operation the cast is held in the lap, and the blows should be given in the direction of the axis which presents the greatest inertia. The mould is thus readily detached; its entire superior surface being removed before the base is attacked.

If the cast be not immediately made, the mould becomes dry, and must be soaked in water before the application of the soap. If the operation be delayed for several days, the plaster of the mould becomes so hard as to be with difficulty broken. If the cast be allowed to remain a few hours in the mould, the oil is absorbed and the surfaces are with difficulty separated.

If a duplicate cast be desired, a permanent mould (*stampa buona*) is made upon this first cast, which then serves as the model. The model is well oiled and plaster is applied in small masses, each capable of being detached from its various curves and angles. The first piece is detached and its edges squared with a sharp knife, after which it is oiled and replaced to aid in the formation of the next. These fragments are numerous when the model is complicated. Drapery, and statuettes such as are common in the shops, sometimes require several hundred, which are kept in place by an outer covering or garment (*camisia*) of plaster in large fragments. When dry, the mould is heated and saturated with boiled linseed oil at a high temperature. This gives tenacity to the plaster, and secures when cold a polished surface, which needs only to be oiled when a cast is required. The pieces are detached in the inverse order of their formation, and such a mould yields an indefinite number of casts.

DESCRIPTION OF PLATES.

STRABISMUS. — PLATE I.

Fig. 1. Speculum for upper or lower Lid.
" 2. Hook for Conjunctiva.
" 3. Double Hook for Sclerotic.
" 4. "Crochet Bistouri" of Baudens, with Porte Sponge.
" 5. Blunt Hook of Dieffenbach.
" 6. Tenotome of Guerin. (See p. 21.)
" 7. Side view of Tenotome of Guerin.
" 13. Snowden's Blephareirgon, modified.

TENOTOMY. — PLATE I.

Fig. 8. Common pointed Tenotome.
" 9. Common blunt Tenotome.
" 10. Myotome for Dorsal Muscles.
" 11. Front view of the same.
" 12. Guerin's Tenotome for Sterno-cleido-mastoid Muscle.
" 13. Self-acting Speculum for Lids.

CLUB-FOOT. EQUINUS. — PLATE II.

Fig. 14. Foot-board of Stromeyer. (See p. 82.)
" 15. Scarpa's Boot, and Sole of the same. (See p. 82.)
" 16.
" 17. Graduated Movement.
" 18.

CLUB-FOOT. VARUS.—Plate III.

Fig. 19. **Contrivance for reducing Varus to Equinus.** (See p. 83.)
" **20.** **Dieffenbach's Contrivance for the same.** (See p. 83.)
" **21.** **Little's Apparatus for treatment of Varus.** *a*, pivot for the metal leg piece, of which the movements of flexion and extension are limited by the shoulders, *c* and *b*, of the horizontal screw traversing the collar *c*. *d*, fixed metal attachment for toe strap. *e*, strap to bring down the heel.
" 22. } Duval's apparatus for Varus. *a*, leg piece governed by a grad-
" 23. } uated universal joint at *c*. (See Fig. 17.)
" 22. Oblique view of the same, to show *b*, a cushioned metal plate of which the posterior edge is advanced against the heel by screws, *a*, working in the plate *c*. *d*, key for perpetual screws.

TORTICOLLIS.—Plate IV.

Fig. 24. Minerva of Delacroix modified by Bouvier. (See p. 95.) *a*, metal band for pelvis. *b*, metal upright. *c*, shoulder straps. *d*, head band. *e*, vertical head band. *f*, chin strap. *g*, metal upright at back of neck. *l*, pin to regulate its length. *i*, graduated flexion, governed by *g*. *k*, graduated rotation. (See Fig. 16.) *m*, joint permitting extension but not flexion. *n*, graduated lateral movement.
" 25. Phillips's Cravat. (See p. 96.) *a*, collar. *b*, metal upright (see Fig. 27) capable of being raised or depressed. *c*, back piece, confined by waist strap and shoulder straps.
" 27. Back view of Fig. 25.
" 26. Bonnet's Apparatus. *a*, cap for knee. *b*, carriage for foot, drawn upon wheels, *b*, towards *d*, by weight or otherwise.

FALSE ANCHYLOSIS OF KNEE JOINT.—Plate V.

Fig. 28. } Duval's Apparatus.
" 30. }
" 29. Little's Apparatus. (See p. 104.) *a*, extension. *f*, counter extension. *e*, cap for depressing knee. *b*, stiff pad for supporting head of tibia by means of *c*, straps. *d*, screw for applying lateral force to head of tibia.

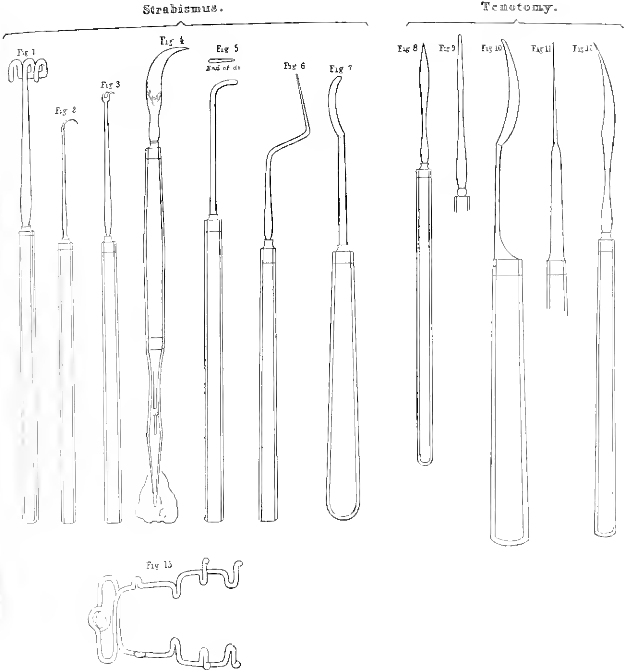
LATERAL CURVATURE OF THE SPINE. — Plate VI.

Fig. 31. Guerin's bed for sigmoid extension. (See pp. 136–138.) *a*, upper table. *b*, lower table. (See Fig. 34.) *c*, middle table. (See Fig. 32.) *d*, spring to impart elasticity to *e*, the point of counter extension, supporting the helmet. (See Fig. 31.) *f*, slide for the support of *d*. *g*, *g*, to support the middle table of the bed. *h*, *h*, lateral centres of flexion.

" 34. Part of the same furnished with its cushions. *d*, *d*, lateral uprights attached to the upper and middle tables, and capable of being advanced upon the convexity of the spiral curves.

" 32. Bed for parallel extension and simple flexion.

" 33. Helmet with its collar and apparatus for lateral flexion.


Strabismus.
Temotomy.
Fig 1
Fig 2
Fig 3
Fig 4
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End of do
Fig 6
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Fig 12
Fig 13

PLATE II.

Equinus.

Fig 14

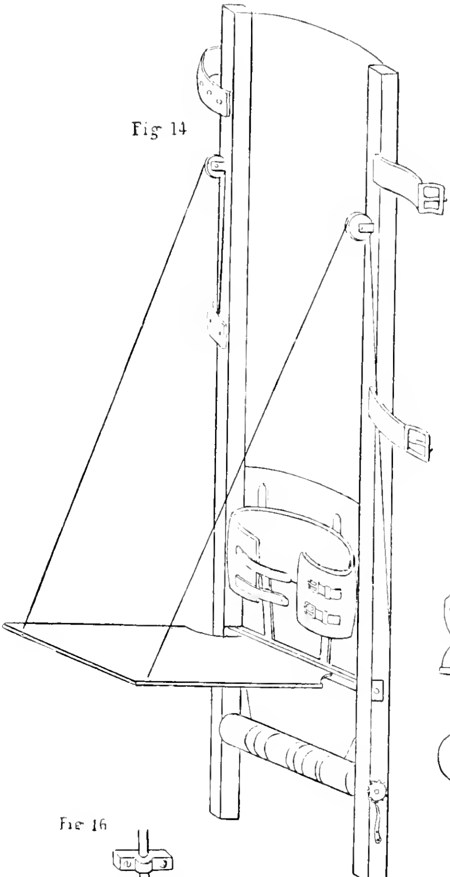


Fig 15

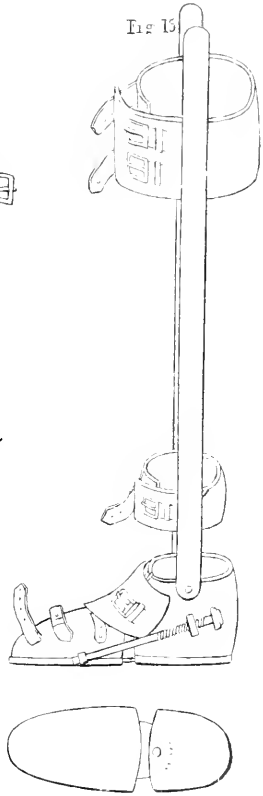


Fig 16

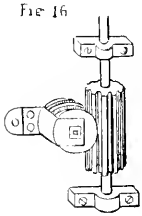


Fig 17

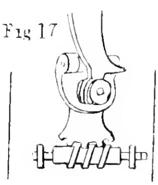
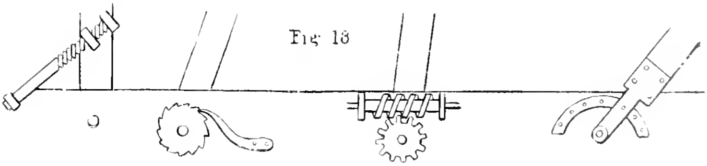


Fig 18



Varus.

Fig. 19

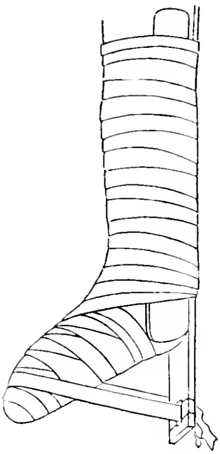


Fig. 20

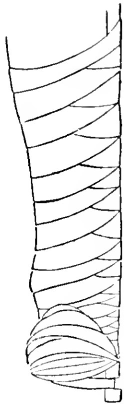


Fig 21.

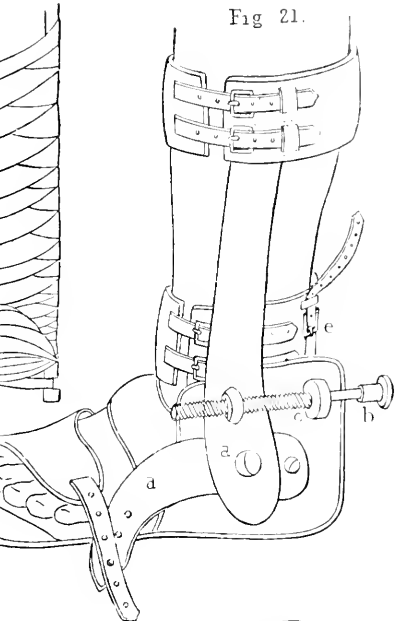
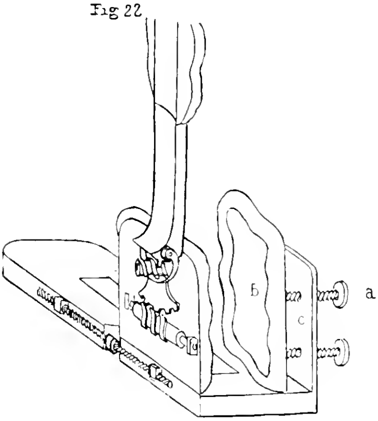


Fig 22



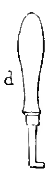
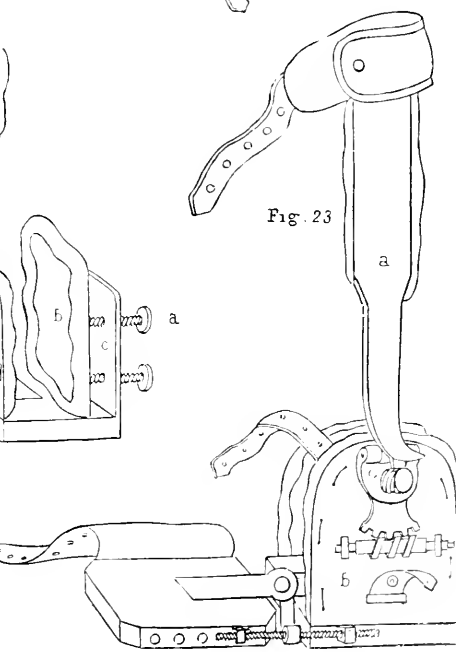


Fig. 23



Torticollis.

Fig 24

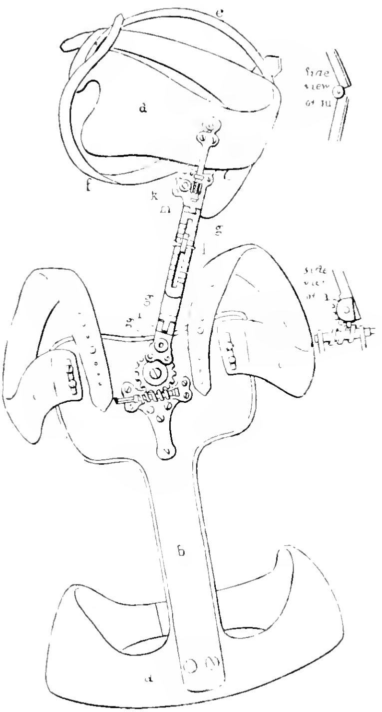


Fig 25

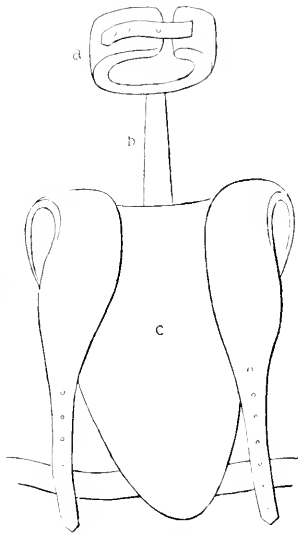


Fig 27

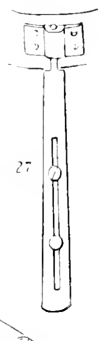
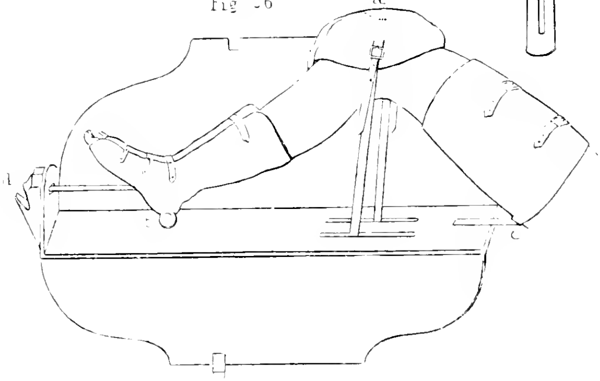


Fig 26



False Anchylosis of Knee Joint.

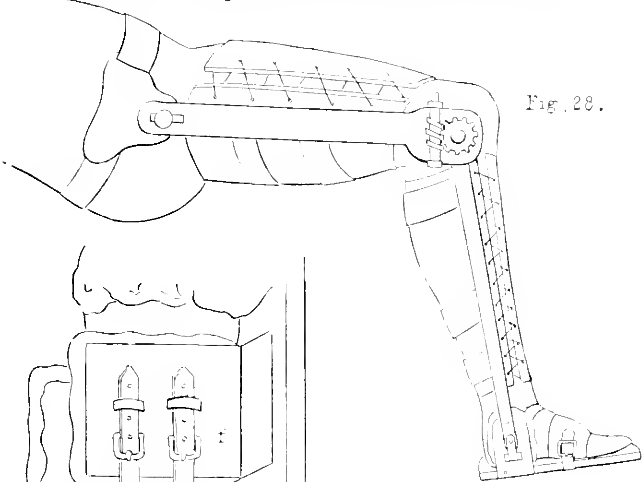


Fig. 28.

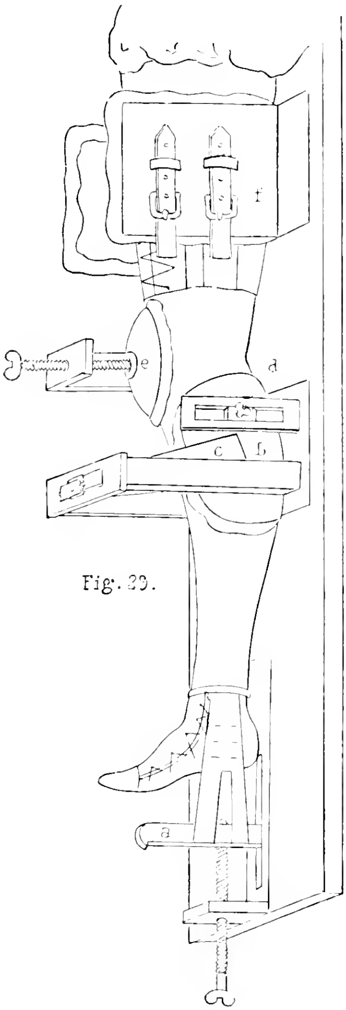


Fig. 29.

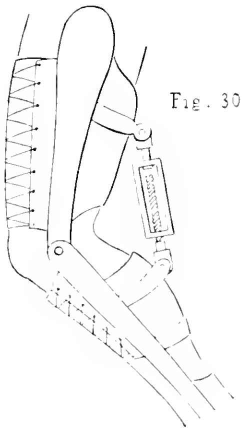
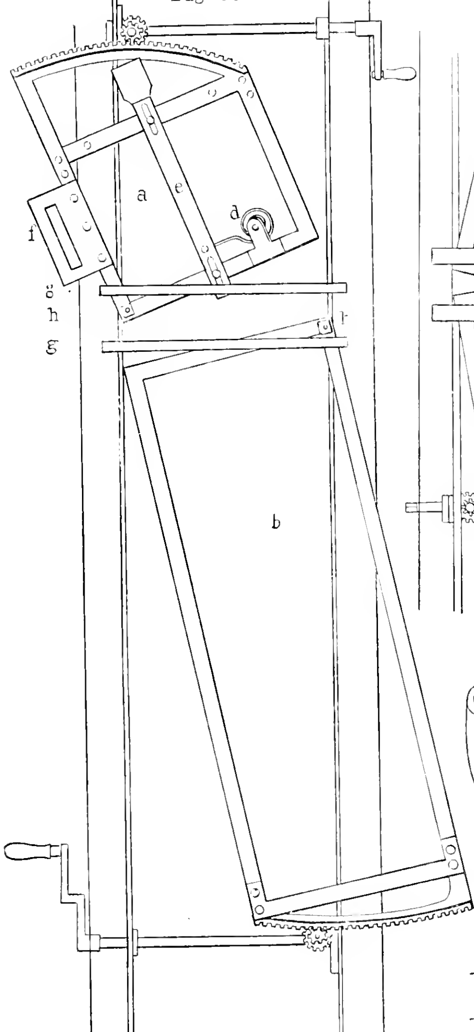
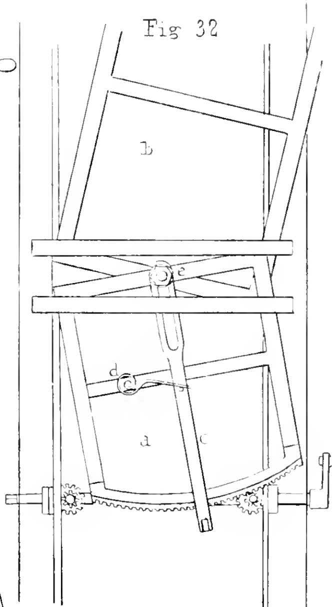


Fig. 30.

Lateral Curvature.

Fig. 31





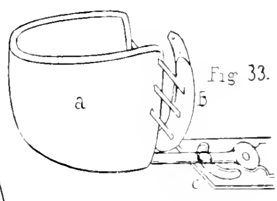
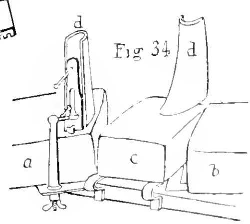


Fig 33.



MEDICAL PAPERS.

DR. BOWDITCH'S "YOUNG STETHOSCOPIST."[1]

We have derived much pleasure from Dr. Bowditch's book. The author evidently has a good practical estimate of the value of physical exploration. Instance such sentences as these: "Do not trouble yourself so much about nice distinctions of sound, but observe accurately, first, where the sounds are heard, second, where the focus of them is, supposing that they exist everywhere in both lungs, and, third, their combinations with other physical and rational signs." (p. 37.) Again, "It is of no importance for the pupil to trouble himself to decide definitely whether he hears bronchophony, ægophony, or the various kinds of pectoriloquy. It is sufficient that, on a comparison between the lungs, he finds an increased or diminished natural resonance in any part. The other physical and rational symptoms, when compared with even these apparently doubtful signs, will enable him to arrive at a correct diagnosis." (p. 29.)

This is refreshing after the refinements of Fournet and Piorry. It is truth we rarely hear. It sums up questions commonly left for the student to decide, but which he cannot settle until he has waded through the whole tract of study. But who reads through Tweedie, or Middlemore, or Andral's Clinique, or Velpeau's Surgery? Who, if he did, could hold all the facts in these great storehouses? We go to market for them when we are in want. We refer to them. We furnish our own books and lectures from them. We

[1] A Review, from the Boston Medical and Surgical Journal, March 18, 1846.

draw from them as Johnson did from other books to write a dictionary. But neither did he, nor do the authors themselves, nor can we, retain all the facts these books include; yet we should be sorry to avow that we were ignorant of their leading principles. There is something to be got at short of reading mammoth treatises, and it is precisely this that the beginner wants; he wants the principles, and he gets them in such a book as this before us. Even in large works medical students do not generally ask for a copious statement of facts, or a wide range of authorities; few practitioners do; they have not time, perhaps inclination, to boil down crudities and to extract their valuable principles. It is a much more natural division of labor which leaves to the student only the care of digesting the material which somebody else has collected and prepared.

In this culinary capacity, there are a variety of ways in which medical compilers may serve up original or other facts; and it is a nice problem to prepare this intellectual food, and to adapt it at once to the infancy or the maturity of its consumers. There is a range from the *vade mecum*, or portable soup style which presents the gist of the matter in its most concentrated form, to the *potage maigre*, diluted with a formal statement of obvious considerations, and the *Julienne* or *Geaufret* of Copland or Cooper or Ben. Bell.

Our theory is, that students prefer knowledge in its concentrated form. First, because the deglutition is facilitated. A certain mental effort attends the process of acquisition, and this effort, if simple, convulsive, and brief, is more salutary than when prolonged till it fatigues. And much of medical knowledge does fatigue the student. It fails to captivate the imagination. It is more useful than palatable. It goes down easier if rolled into the pill-like sphericity of aphorisms. We believe it is natural for the mind to require knowledge in this condensed form before it proceeds to expand it; we

want the corollary before the demonstration, the hypothesis before the facts, the bill of fare before the dinner. We require to know what kind of intellectual accommodations a given subject is likely to exact, before we proceed to take it in. A subsequent process is that of settling things into their places, of digesting, or rather of ruminating; and when the subject is thus again brought up, any modification or addition is made to suit the taste of the individual.

Accordingly, in many sciences, especially in the classificatory sciences, where facts are numerous, the mind has resorted to this stenographic mode of getting possession of all that is most important before it indulges the imagination with interesting detail or pleasant associations." Birds are "lobe-footed" with "primaries ash," and leaves are identified as "pinnate" or "pilose" before we hear of their brilliant colors or curious habits. Let us modify such a description to illustrate these differences; for example,—from Linnæus: The plant "Geranium maculatum. . . . Peduncles two-flowered; stem forked, erect, leaves five-parted and cut, the two upper ones sessile." The monograph is complete, and enables us to identify the plant. Spreading the facts a little thinner, we might say: "This interesting plant is found both in the woods and by the roadside. Its peduncles are long and hairy, commonly supporting two flowers, occasionally more. The stems are also hairy, erect, dividing by forks or more numerous branches." Or, modestly introducing ourselves to the reader, after the manner of John Bell: "I really consider this fine plant quite as attractive as most of the pampered inhabitants of our greenhouses. With a few drops of moisture, it springs from the soil, and I have found it growing, utterly regardless of the advantages of position, under the patronage of some sturdy old fence, or on the very brink of an awful and overwhelming cataract."

But business is business. Law reports do not tell us how

Mrs. Doakes felt during her husband's litigation, nor what the lawyer said to console her. Neither do we want to know that a case of melanosis was respected and beloved, nor that the doctor was called in or anxious. It may be interesting, but it is out of place. It belongs to the affections, not the intellect; to practice, not theory; to society, not science; to the individual, not the profession. We want the naked facts.

We are all aware that he who puts two things together and pleases the imagination has a far more grateful office than he who reverses the process, and in pointing out differences only exercises a scientific discrimination. Besides, imagination is a gift; it excites admiration, and we are insensibly moved to reward it, while good judgment combined with persevering industry will make anybody an average scientist; it affords us no especial pleasure; it consequently puts us under no obligation, and it is very apt to get only its "thwacks and thistles."

We believe that imagination has its proper office in science; but it should be heavily ballasted with judgment. It then belongs to the discoverer, and is intended for the perception of real, and not of fanciful or poetical resemblances. It may also amuse, as far as it can, without substituting the entertaining for the true. But we hold that there are at least two classes of readers who prefer a concise statement of facts, divested of ornament; the one a numerous body, who do not appreciate efforts of the imagination; the other, those who when they seek for facts do not look for wit, who prefer to have their salt kept separate, and to help themselves to it. Of this number are most medical students; they want little imaginative entertainment in their medical grammars. They are to make an exertion, to toil up an elevation bristling with new facts. Youth has activity, but wind and dogged bottom are the prerogatives of maturity; it is obviously easier to stride over a *vade mecum* with an

occasional clonic spasm, than to ascend the gently inclined plane of some flowery but protracted octavo.

Mere imaginative adulteration is, we conceive, still more objectionable. Without alluding to the caterers of irrelevant or noxious facts, we will mention one common way of impairing the spirit of a book; of reducing its proof. It presents old things as new, and imparts with the severity of science facts which possibly are new in their medical application, but old as the learner's every-day experience. For example, most medical students are familiar, to judge from the devices upon lecture-room benches, with the use of knives; and yet, at the outset of operative surgery, the student must learn anew five different positions of holding his scalpel. The crepitus of fracture is surgical myth, and the reduction of a dislocated finger is described in pages; and yet it sometimes happens that some bystander has settled the question of fracture, or has pulled a bone into its place before the surgeon arrives upon the scene of accident. We venture to affirm that no practical man could hear an amphoric respiration without feeling sure that it came from a cavity. Something might undoubtedly be added to this popular medical knowledge, even in the other sex; but it seems to us quite as true that undue weight is often given in scientific books to medical positions which are truisms in every-day non-medical experience, and that the most satisfactory work to the student is that which passes lightly over such considerations, and dwells upon medical occurrences which do not happen as his general experience would lead him to expect.

If we are right, students at first need only the important facts; such as are necessary and sufficient to a "determinative analysis" of disease. Nor do they want the pathological biographies of individuals, but general results and model cases, — type cases, succinct and portable, to which subsequent exceptions may be appended.

We remember saying to a well-known French writer, who added the notes to the French edition of Hunter's works, that we had learned much with little labor from these articles condensed into aphorisms. "Ah!" replied he, "that style would make books scarce; those few pages contain matter for a small octavo."

For the possession of this kernel, the reader is ever struggling with the author, whose instincts would bury it among octavo pages; but it requires great practice to "gut" a book quietly; with most readers the effort becomes harassing. Rostan, with French hyperbole, makes it fatal to both parties: "L'auteur se tue à allonger ce que le lecteur se tue à abréger."

With these politics we once proposed to try our hand at condensing the subject of Dr. Bowditch's book, the standard and gage of compression being utility in every-day practice. The programme passed by certain points, which, like the phenomena of succussion, are scientifically interesting, but comparatively useless because they indicate lesions already discovered by other signs, and dwelt on certain other non-auscultatory signs and symptoms which are diagnostic or pathognomonic. These often occur: there are cases of undoubted tubercle where auscultation tells us nothing; and we derive our knowledge of the lesion from common signs and symptoms. It would be quite as annoying to be here out-diagnosed by one behind the age in science and ignorant of the improved method, as to find our neighbor succeeding with a pork bait while we were attempting the fruitless mysteries of lancewood and red hackles.

We once thought of it; but Dr. Bowditch occupies the unoccupied ground. He has booked Laennec up to date, and has compressed his genius, as the fisherman in the Arabian Nights did his, into a prodigiously small volume; yet it contains separate articles upon percussion, common and

auscultatory; auscultation thoracic, fœtal, cephalic, and veterinary; of course no duplicate specimens nor *jactolites;* but all the regular aggregations of the books, while many original and floating facts are crystallized about their appropriate heads. We commend it to auscultors and to non-auscultors.

NEW PHYSICAL SIGN.[1]

This is a rapid ticking sound in the throat, audible across the room, involuntary, and independent of circulation or of respiration,— a phenomenon interesting from its anomalous character rather than its diagnostic value.

The subject who presents this curious physical sign is a rather pretty girl of seventeen, small in stature, and of healthy appearance,—Jane McMurphy, of Derry, New Hampshire. I am indebted to her physician, Dr. Wallace, for the opportunity to examine this interesting case.

From her own account, which is here subjoined, her general health has been impaired for some time past. Five years ago a piece of tobacco was inserted in her right ear for an ear-ache by an old woman. Of this piece of tobacco, the patient saw no more at that time, but at the end of a month, and for three subsequent months, a physician made frequent attempts to extract it, and succeeded on one occasion in removing what was said to be a fragment of tobacco. At the end of a year two more fragments were extracted, with some force, after the use of a caustic or "*burning*" liquid.

During this year the pain in the ear and right side of the head continued, and at one time with considerable swelling in the region of the parotid, threatening, as her physician stated, to open and discharge.

During three subsequent years the head was frequently painful, — the pain sometimes darting, at other times suggesting the sensation of cold water in the cavity of the

[1] The Boston Medical and Surgical Journal, November 3, 1847.

cranium, — these symptoms, chiefly confined to the right side, being occasionally so severe as to make the patient cry, and even confine her to bed several days at a time.

In March, 1846, the right side of the face swelled as before, the tumefaction occupying chiefly the region of the cheek, mastoid process, and parotid. While lying in bed a few days after the attack the patient first heard this noise, and was at a loss to account for it. It commenced suddenly, somewhat slower than at present, but the same in character. Since then, it has continued with little intermission. There has been no discharge from the ear other than that following the violence used in the extraction of the supposed foreign body, nor has the hearing been affected. The mastoid region has been at times universally tender, and now presents a sensitive point a quarter of an inch in diameter at about its centre, though the pain in the head during the last year has been comparatively slight.

A person sitting in the same room with this patient hears a distant muffled sound, which might easily be mistaken for the rapid dropping of water into the pail of a closed wash-stand. An idea of the sound may be conveyed by the words *click*, *click*, *click*, or occasionally *click-click*, *click-click*, etc. Being requested to open her mouth, it becomes surprisingly distinct and audible, and, apparently stimulated by the effort or by the contact of air, the ticking becomes rapid, sometimes single, sometimes reduplicated, irregular, pausing for an instant, then giving six or eight explosions in rapid succession, to be again followed by pauses and single or double vibrations as before. It is now no longer muffled, but sharp and distinct, deriving a little cavernous intonation from the fauces or larynx, but otherwise resembling the snapping of the finger-nails or of a quill pen, the distant sound of castanets, or, which is a better comparison, the irregular clicking of the electro-magnet attached to the

telegraph, to which it was very happily compared by my friend Dr. Gould. All this while the patient sits quiet and unmoved, as if unconscious of anything unusual. It is not so, however. Upon being questioned, she refers the seat of the noise to a spot on the right side of the neck, near the summit of the thyroid cartilage, and upon it. This is discovered by the touch, and by the stethoscope, to be the maximum of the vibration. The noise can be stopped by pressing upon this point so as to displace the larynx. The patient describes a sensation of "drawing" when the chin is carried to the left, and of "something running into" or penetrating the tissues when the chin is carried to the right, so as to compress the region. But besides this, and a considerable "soreness" which exists in the neighborhood, she experiences no inconvenience from the noise.

Internally the fauces are red; and here an important feature of the case is found. The uvula is alternately and spasmodically retracted and relaxed synchronously with the explosions; sometimes four or five times in a second. This spasmodic muscular action is extended to the soft palate and to the pillar of the right side, and the whole appearance is such that in looking for the first time into the throat all difficulty in the diagnosis seems to be at an end. The sound appears to come from the soft palate. Yet I think this is not its real source. The uvula can be seized and drawn forward, and the soft palate may be compressed against the vertebral column, and the noise goes on; less rapidly, to be sure, but I think unequivocally. Besides, the maximum of the sound is not in this region.

Upon depressing the tongue, the epiglottis is brought into view rather low down, but motionless while the noise continues.

What, then, is the source of the sound? First, as regards its seat. This seems to be at the point already described;

viz. just below the summit of the thyroid cartilage on the right side. Secondly, the *motor power* is apparently a spasmodic action of the muscles in the neighborhood of the fauces or larynx, — an action analogous to that of chorea. On the other hand, it is very likely that the spasmodic action is induced by the irritation of the neighboring bone, if it be diseased. Thirdly, as to the proximate mechanism of the sound. This, the chief interest in the case, is unfortunately of doubtful origin. Two mechanical combinations, and only two, appear to me sufficient to produce an occurrence of this nature. Of these, one is the rapid passing and repassing of two hard surfaces in contact with each other, like the movement by which the finger and thumb nail are snapped together. Broken portions of the os hyoides, or of an ossified cartilage, might also produce, by the aid of the muscles, a crepitus of this anomalous character. Yet it is probable that the impinging fragments would be worn smooth in time, and the sound thus modified. At any rate there is no discoverable discharge of pus or blood which would accompany fracture or necrosis in this region. The evidence is against such a condition of the parts.

The other explanation of the sound lies in an alternate opening and closure of the moist mouth of a sac, by which a bubble of air is expelled at each contraction, and a bubble sucked in at each dilation of its cavity. Such a sac exists between the vocal cords, or might be formed at one extremity of the os hyoides, with a fistulous opening.

Of these two possible causes, the former seems to be, on the whole, the more probable, though the extreme distinctness and the force of the explosions, and above all their great rapidity, render it difficult to accept its supposition.

Such a solution of the cause of this singular phenomenon is far from satisfactory, yet it is difficult to adduce any additional evidence of its nature. The patient was examined by

many medical gentlemen before and during her visit to Boston, both at the Hospital and at the Society for Medical Improvement, to whom I presented the case.

In relation to the medical treatment to which the patient has been subjected, it may be stated that before her entrance into the Hospital a great variety of tentative remedies had been adopted. Among them were a course of electricity during seven weeks,— two setons of five and seven weeks respectively,— blisters, leeches, iodine, and internal local cauterization,— all without effect. An external application of the ointment of veratria suspended the spasmodic action, and also the noise, during a number of hours, when it again recurred. During her residence in the Hospital, I deemed it unnecessary to harass the patient by repeating applications which seem to have been faithfully tried; and the patient has been altogether unwilling to submit to the division of one of the pillars of the palate which I proposed to her. If the spasmodic contraction can be considered to partake of the nature of chorea, the age of the patient renders a spontaneous termination of the affection not improbable. On the other hand, if it be provoked by any inflammatory state of the hard parts, it will not improbably subside when this affection, which seems to be diminishing, shall disappear.

CASE OF INJURY OF HEAD.[1]

THE following case, perhaps unparalleled in the annals of surgery, and of which some interesting details have already been published, occurred in the practice of Dr. J. M. Harlow, of Cavendish, Vermont. Having received a verbal account of the accident a few days after its occurrence from a medical gentleman who had examined the patient, I thus became incidentally interested in it; and having since had an opportunity, through the politeness of Dr. Harlow, of observing the patient, who remained in Boston a number of weeks under my charge, I have been able to satisfy myself as well of the occurrence and extent of the injury as of the manner of its infliction. I am also indebted to the same gentleman for procuring at my request the testimony of a number of persons who were cognizant of the accident or its sequel.

Those who are sceptical in admitting the coexistence of a lesion so grave with an inconsiderable disturbance of function, will be interested in further details connected with the case; while it is due to science that a complete record should be made of the history of so remarkable an injury.

The accident occurred upon the line of the Rutland and Burlington Railroad, on the 13th of September, 1848. The subject of it, Phineas P. Gage, is of middle stature, twenty-five years of age, shrewd and intelligent. According to his own statement, he was charging with powder a hole drilled

[1] From the American Journal of the Medical Sciences, July, 1850, entitled "Dr. Harlow's Case of Recovery from the Passage of an Iron Bar through the Head."

in a rock for the purpose of blasting. It appears that it is customary in charging the hole to cover the powder with sand. In this case, the charge having been adjusted, Mr. Gage directed his assistant to pour in the sand; and at the interval of a few seconds, his head being averted, and supposing the sand to have been properly placed, he dropped the head of a tamping iron as usual upon the charge, to consolidate or "tamp it in." The assistant had failed to obey the order, and, the iron striking fire upon the rock, the uncovered powder was ignited, and an explosion took place. Mr. Gage was at this time standing above the hole, leaning forward, with his face slightly averted: and the bar of iron was projected directly upward in the line of its axis, passing completely through his head and high into the air. The wound thus received, and which is more fully described in the sequel, was oblique, traversing the cranium in a straight line from the angle of the lower jaw on one side to the centre of the frontal bone above, near the sagittal suture, where the missile emerged: and the iron thus forcibly thrown into the air was picked up at a distance of some rods from the patient, smeared with brains and blood.

From this extraordinary lesion the patient has quite recovered in his faculties of body and mind, excepting only the loss of the sight of one eye.

The iron which thus traversed the skull weighs thirteen and a quarter pounds. It is three feet seven inches in length. and one and a quarter inches in diameter. The end which entered first is pointed, the taper being seven inches long, and the diameter of the point one quarter of an inch,—circumstances to which the patient perhaps owes his life. The iron is unlike any other, and was made by a neighboring blacksmith to please the fancy of the owner.

Dr. Harlow, in the graphic account above alluded to, states that "immediately after the explosion the patient was thrown

upon his back, and gave a few convulsive motions of the extremities, but spoke in a few minutes. His men (with whom he was a great favorite) took him in their arms and carried him to the road, only a few rods distant, and put him into an ox cart, in which he rode, sitting erect, full three quarters of a mile, to the hotel of Mr. Joseph Adams, in this village. He got out of the cart himself, and with a little assistance walked up a long flight of stairs into the hall, where his wounds were dressed."

Mr. Joseph Adams, here spoken of, has furnished the following interesting statement: —

This is to certify that P. P. Gage had boarded in my house for several weeks previous to his being injured upon the railroad, and that I saw him and conversed with him soon after the accident, and am of opinion that he was perfectly conscious of what was passing around him. He rode to the house, three quarters of a mile, sitting in a cart, and walked from the cart to the piazza, and thence up stairs, with but little assistance. I noticed the state of the left eye, and know from experiment that he could see with it for several days, though not distinctly. In regard to the elevated appearance of the wound, and the introduction of the finger into it, I can fully confirm the certificate of my nephew, Washington Adams, and others, and would add that I repeatedly saw him eject matter from the mouth similar in appearance to that discharged from the head. The morning subsequent to the accident I went in quest of the bar, and found it at a smith's shop, near the pit in which he was engaged.

The men in his pit asserted that "they found the iron covered with blood and brains," several rods behind where Mr. Gage stood, and that they washed it in the brook and returned it with the other tools; which representation was fully corroborated by the greasy feel and look of the iron, and the *fragments of brain* which I *saw* upon the rock where it fell.

JOSEPH ADAMS,
Justice of the Peace.

CAVENDISH, December 14, 1849.

The Rev. Joseph Freeman, whose letter follows, informed himself of the circumstances soon after the accident.

CAVENDISH, December, 5, 1849.

Dear Sir, — I was at home on the day Mr. Gage was hurt; and seeing an Irishman ride rapidly up to your door, I stepped over to ascertain the cause, and then went immediately to meet those who I was informed were bringing him to our village.

I found him in a cart, sitting up without aid, with his back against the foreboard. When we reached his quarters, he rose to his feet without aid and walked quick, though with an unsteady step, to the hind end of the cart, when two of his men came forward and aided him out, and walked with him, supporting him to the house.

I then asked his men how he came to be hurt? The reply was, "The blast went off when he was tamping it, and the tamping-iron passed through his head." I said, "That is impossible."

Soon after this, I went to the place where the accident happened. I found upon the rocks, where I supposed he had fallen, a small quantity of brains. There being no person at this place, I passed on to a blacksmith's shop a few rods beyond, in and about which a number of Irishmen were collected. As I came up to them, they pointed me to the iron which has since attracted so much attention, standing outside the shop door. They said they found it covered with brains and dirt, and had washed it in the brook. The *appearance* of the iron corresponded with this story. It had a greasy appearance, and was so to the touch.

After hearing their statement, as there was no assignable motive for misrepresentation, and finding the appearance of the iron to agree with it, I was compelled to believe, though the result of your examination of the wound was not then known to me.

I think of nothing further relating to this affair which cannot be more minutely stated by others.

Very respectfully yours,

JOSEPH FREEMAN.

DR. J. M. HARLOW.

Dr. Williams first saw the patient, and makes the following statement in relation to the circumstances: —

NORTHFIELD, VERMONT, December 4, 1849.

Dear Sir, — Dr. Harlow having requested me to transmit to you a description of the appearance of Mr. Gage at the time I first saw him after the accident, which happened to him in September, 1848, I now hasten to do so with pleasure.

Dr. Harlow being absent at the time of the accident, I was sent for, and was the first physician who saw Mr. Gage, some twenty-five or thirty minutes after he received the injury; he at that time was sitting in a chair upon the piazza of Mr. Adams's hotel in Cavendish. When I drove up, he said, "Doctor, here is business enough for you." I first noticed the wound upon the head before I alighted from my carriage, the pulsations of the brain being very distinct. There was also an appearance which, before I examined the head, I could not account for: the top of the head having a shape somewhat like an inverted funnel; this was owing, I discovered, to the bone being fractured about the opening for a distance of about two inches in every direction. I ought to have mentioned above that the opening through the skull and integuments was not far from one and a half inches in diameter; the edges of this opening were everted, and the whole wound appeared as if some wedge-shaped body had passed from below upward. Mr. Gage during the time I was examining this wound was relating the manner in which he was injured to the bystanders; he talked so rationally and was so willing to answer questions that I directed my inquiries to him in preference to the men who were with him at the time of the accident, and who were standing about at this time. Mr. Gage then related to me some of the circumstances, as he has since done; and I can safely say that neither at that time nor on any subsequent occasion, save once, did I consider him to be otherwise than perfectly rational. The one time to which I allude was about a fortnight after the accident, and then he persisted in calling me John Kirwin; yet he answered all my questions correctly.

I did not believe Mr. Gage's statement at that time, but thought he was deceived; I asked him where the bar entered, and he pointed to the wound on his cheek, which I had not before discovered; this was a slit running from the angle of the jaw forward about one inch and a half; it was very much stretched laterally, and was discolored by powder and iron rust, or at least

appeared so. Mr. Gage persisted in saying that the bar went through his head. An Irishman standing by said, "Sure it was so, sir, for the bar is lying in the road below, all blood and brains." The man also said he would have brought it up with him, but he thought there would be an inquest, and it would not do.

About this time, Mr. Gage got up and vomited a large quantity of blood, together with some of his food; the effort of vomiting pressed out about half a teacupful of the brain, which fell upon the floor, together with the blood, which was forced out at the same time. The left eye appeared more dull and glassy than the right. He said he could merely distinguish light with it.

Soon after Dr. Harlow arrived, Mr. Gage walked up stairs, with little or no assistance, and laid down upon a bed. Dr. Harlow made a thorough examination of the wounds, passing the whole length of his forefinger into the superior opening without difficulty; and my impression is that he did the same with the inferior one, but of that I am not absolutely certain; after this we proceeded to dress the wounds in the manner described by Dr. Harlow in the Journal. During the time occupied in dressing, Mr. Gage vomited two or three times fully as freely as before. All of this time he was perfectly conscious, answering all questions, and calling his friends by name as they came into the room.

I did not see the bar that night, but saw it the next day after it was washed.

Hoping you will excuse this hasty sketch, I remain yours, etc.

EDWARD H. WILLIAMS, M. D.

DR. H. J. BIGELOW.

Dr. Harlow's account of his first visit to the patient, and of the subsequent symptoms, is here appended.

"Being absent, I did not arrive at the scene of the accident until near six o'clock, P. M. You will excuse me for remarking here that the picture presented was, to one unaccustomed to military surgery, truly terrific; but the patient bore his sufferings with the most heroic firmness. He recognized me at once, and said he hoped he was not much hurt. He seemed to be perfectly conscious, but was getting exhausted from the hemorrhage, which

was very profuse both externally and internally, the blood finding its way into the stomach, which rejected it as often as every fifteen or twenty minutes. Pulse sixty, and regular. His person and the bed on which he was laid were literally one gore of blood. Assisted by my friend, Dr. Williams of Proctorsville, who was first called to the patient, we proceeded to dress the wounds. From their appearance, the fragments of bone being uplifted and the brain protruding, it was evident that the fracture was occasioned by some force acting from below upward. The scalp was shaven, the coagula removed, together with three small triangular pieces of the cranium, and in searching to ascertain if there were other foreign bodies there, I passed in the index finger its whole length, without the least resistance, in the direction of the wound in the cheek which received the other finger in like manner. A portion of the anterior superior angle of each parietal bone, and a semicircular piece of the frontal bone were fractured, leaving a circular opening of about three and a half inches in diameter. This examination, and the appearance of the iron, which was found some rods distant smeared with brain, together with the testimony of the workmen, and of the patient himself, who was still sufficiently conscious to say that 'the iron struck his head and passed through,' was considered at the time conclusive not only of the nature of the accident, but of the manner in which it occurred.

"I have been asked why I did not pass a probe through the entire extent of the wound at the time. I think no surgeon of discretion would have upheld me in the trial of such a foolhardy experiment, in the risk of disturbing lacerated vessels, from which the hemorrhage was near being stanched, and thereby rupturing the attenuated thread by which the sufferer still held to life. You will excuse me for being thus particular, inasmuch as I am aware that the nature of the injury has been seriously questioned by many medical men for whom I entertain a very high respect.

"The spicula of bone having been taken away, a portion of the brain, which hung by a pedicle, was removed, the larger pieces of bone replaced, the lacerated scalp brought together as nearly as possible and retained by adhesive straps, excepting at the posterior angle, and over this a dressing of compress, night-

cap, and roller were placed. The wound in the face was left patulous, covered only by a simple dressing. The hands and forearms, both deeply burned nearly to the elbows, were dressed, and the patient was left with the head elevated, and the attendants were requested to keep him in that position.

"10 P. M., same evening. The dressings are saturated with blood, but the hemorrhage appears to be abating. Has vomited twice only since being dressed. Sensorial powers remain as yet unimpaired. Says he does not wish to see his friends, as he shall be at work in a day or two. Tells where they live, their names, etc. Pulse 65; constant agitation of the lower extremities.

"September 14, 7 A. M. Has slept some; appears to be in pain; speaks with difficulty; tumefaction of face considerable, and increasing; pulse 70; knows his friends and is rational. Asks who is foreman in his pit. Hemorrhage internally continues slightly. Has not vomited since 12 P. M.

"September 15, 9 A. M. Has slept well half the night. Sees objects indistinctly with the left eye when the lids are separated. Hemorrhage has ceased; pulse 70.—8 P. M. Restless and delirious; talks much, but disconnected and incoherent; pulse 84 and full. Prescribed wine of colchicum, f℥ss every six hours, until it purges him. Removed the nightcap.

"September 16, 8 A. M. Patient appears more quiet; pulse 70. Dressed the wounds, which in the head have a fetid sero-purulent discharge, with particles of brain intermingled. No discharge from bowels. Ordered sulphate of magnesia, ℥j, repeated every four hours until it operates. Iced water to the head and eye. A fungus appears at the external canthus of the left eye. Says the left side of his head is banked up.

"September 17, 8 A. M. Pulse 84. Purged freely. Rational, and knows his friends. Discharge from the brain profuse, very fetid and sanious. Wounds in face healing.

"September 18, 9 A. M. Slept well all night, and lies upon his right side. Pulse 72; tongue red and dry; breath fetid. Removed the dressings, and passed a probe to the base of the cranium, without giving pain. Ordered a cathartic, which operated freely. Cold to the head. Patient says he shall recover. He is delirious, with lucid intervals.

"September 19, 8 P. M. Has been very restless during the day; skin hot and dry; tongue red; excessive thirst; delirious, talking incoherently with himself, and directing his men.

"September 20 and 21. Has remained much the same.

"September 22, 8 A. M. Patient has had a very restless night. Throws his hands and feet about, and tries to get out of bed. Head hot. Says he shall not live long so. Ordered a cathartic of calomel and rhubarb, to be followed by castor oil, if it does not operate in six hours. — 4 P. M. Purged freely twice, and inclines to sleep.

"September 23. Rested well most of the night, and appears stronger and more rational. Pulse 80. Shaved the scalp a second time, and brought the edges of the wound in position, the original edges having sloughed away. Discharge less in quantity and less fetid. Loss of vision of left eye.

"From this time until the 3d of October he lay in a semi-comatose state, seldom speaking unless spoken to, and then answering only in monosyllables. During this period fungi started from the brain, and increased rapidly from the orbit. To these nitrate of silver was applied, and cold to the head generally. The dressings were renewed three times in every twenty-four hours; and in addition to this, laxatives combined with an occasional dose of calomel constituted the treatment. The pulse varied from 70 to 96, — generally very soft. During this time an abscess formed under the frontalis muscle, which was opened on the 27th, and has been very difficult to heal. Discharged nearly eight ounces at the time it was punctured.

"October 5 and 6. Patient improving. Discharge from the wound and sinus, laudable pus. Calls for his pants, and wishes to get out of bed, though he is unable to raise his head from the pillow.

"October 7. Has succeeded in raising himself up, took one step to his chair, and sat about five minutes.

"October 11. Pulse 72. Intellectual faculties brightening. When I asked him how long since he was injured, he replied 'Four weeks this afternoon, at half past four o'clock.' Relates the manner in which the accident occurred, and how he came to the house. He keeps the day of the week and time of day in his mind. Says he knows more than half of those who inquire after

him. Does not estimate size or money accurately, though he has memory as perfect as ever. He would not take one thousand dollars for a few pebbles which he took from an ancient river bed where he was at work. The fungus is giving way under the use of the nitrate of silver. During all of this time there has been a discharge of pus into the fauces, a part of which passed into the stomach, the remainder being ejected from the mouth.

"October 20. Improving. Gets out and into bed with but little assistance. Sits up thirty minutes twice in twenty-four hours. Is very childish; wishes to go home to Lebanon, N. H. The wound in the scalp is healing rapidly.

"November 8. Improving in every particular, and sits up most of the time during the day. Appetite good, though he is still kept upon a low diet. Pulse 65. Sleeps well, and says he has no pain in the head. Food digests easily, bowels regular, and nutrition is going on well. The sinus under the frontalis muscle has nearly healed. He walks up and down stairs, and about the house, into the piazza, and I am informed this evening that he has been in the street to-day.—I leave him for a week, with strict injunctions to avoid excitement and exposure.

"November 15. I learn on inquiry that Gage has been in the street every day except Sunday during my absence. His desire to be out and to go home to Lebanon has been uncontrollable by his friends, and he has been making arrangements to that effect. Yesterday he walked half a mile, and purchased some small articles at the store. The atmosphere was cold and damp, the ground wet, and he went without an overcoat, and with thin boots. He got wet feet and a chill. I find him in bed, depressed and very irritable. Hot and dry skin; thirst, tongue coated; pulse 110; lancinating pain in left side of head and face; rigors, and bowels constipated. Ordered cold to the head and face, and a black dose, to be repeated in six hours if it does not operate. He has had spicula of bone pass into the fauces, which he expelled from the mouth within a few days.

"November 16, A. M. No better. Cathartic has operated freely. Pulse 120; skin hot and dry; thirst and pain remain the same. Has been very restless during the night. Venesection sixteen ounces. Ordered calomel, ten grains, and ipecac. two grains, followed in four hours by castor oil.

"8 P. M., same day. Purged freely; pulse less frequent; pain in head moderated; skin moist. ℞. Antim. et potass. tart., three grains; syr. simplicis, six ounces. Dose a dessert-spoonful every four hours.

"November 17. Improving. Expresses himself as feeling better in every respect; has no pain in the head.

"November 18. Is walking about the house again; says he feels no pain in the head, and appears to be in a way of recovering if he can be controlled."

The leading feature of this case is its improbability. A physician who holds in his hand a crowbar, three feet and a half long and more than thirteen pounds in weight, will not readily believe that it has been driven with a crash through the brain of a man who is still able to walk off, talking with composure and equanimity of the hole in his head. This is the sort of accident that happens in the pantomime at the theatre, but not elsewhere. Yet there is every reason for supposing it in this case literally true. Being at first wholly sceptical, I have been personally convinced; and this has been the experience of many medical gentlemen who, having first heard of the circumstances, have had a subsequent opportunity to examine the evidence.

This evidence is comprised in the testimony of individuals, and in the anatomical and physiological character of the lesion itself.

The above accounts from different individuals concur in assigning to the accident a common cause. They are selected as the most complete among about a dozen of similar documents forwarded to me by Dr. Harlow, who was kind enough to procure them at my request. They bear the signature of many respectable persons in and about the town of Cavendish, and are all corroborative of the circumstances as here detailed. The accident occurred in open day, in a quarry in which a considerable number of men were at work,

many of whom were witnesses of it, and all of whom were attracted by it. Suffice it to say, that in a thickly populated country neighborhood, where all the facts were matter of daily discussion at the time of their occurrence, there is no difference of belief, nor has there been at any time a doubt that the iron was actually driven through the brain. A considerable number of medical gentlemen also visited the case at various times to satisfy their incredulity.

Assuming that the wound was the result of a missile projected from below upwards, it may be asked whether the wound might not have been made by a stone, while the bar was at the same moment thrown into the air. It may be said in reply, that the rock was not split, nor, as far as could be learned, disintegrated. Besides, an angular bit of stone would have been likely to have produced quite as much laceration as the bar of iron; and it is in fact possible that the tapering point of the latter divided and repelled the soft parts, especially the brain, in a way that enabled the smooth surface of the iron to glide through with less injury. Assuming the only possible hypothesis, that the round bar followed exactly the direction of its axis, the missile may be considered as a sphere of one and a quarter inches in diameter, preceded by a conical and polished wedge.

The patient visited Boston in January, 1850, and remained some time under my observation, during which he was presented at a meeting of the Boston Society for Medical Improvement, and also to the medical class at the Hospital. His head, now perfectly healed, exhibits the following appearances.

A linear cicatrix of an inch in length occupies the left ramus of the jaw near its angle. A little thickening of the soft tissues is discovered about the corresponding malar bone. The eyelid of this side is shut, and the patient unable to open it. The left eye, considerably more prominent than

the other, offers a singular confirmation of the points illustrated by the prepared skull described below, where it will be seen that the parts of the orbit necessarily cut away are those occupied by the levator palpebræ superioris, the levator oculi, and the abducens muscles. In addition to a ptosis of the lid, the eye is found to be incapable of executing either the outward or upward motion; while the other muscles animated by the motor communis are unimpaired. Upon the head, and covered by hair, is a large unequal depression and elevation. A portrait of the cast of the shaved head is given in the plate; and it will be seen that a piece of cranium of about the size of the palm of the hand, its posterior border lying near the coronal suture, its anterior edge low upon the forehead, was raised upon the latter as a hinge to allow the egress of the bar; and that it still remains raised and prominent. Behind it is an irregular and deep sulcus several inches in length, beneath which the pulsations of the brain can be perceived.

In order to ascertain how far it might be possible for this bar of an inch and a quarter diameter to traverse the skull in the track assigned to it, I procured a common skull in which the zygomatic arches are barely visible from above, and, having entered a drill near the left angle of the lower jaw, passed it obliquely upwards to the median line of the cranium just in front of the junction of the sagittal and coronal sutures. This aperture was then enlarged until it allowed the passage of the bar in question, and the loss of substance strikingly corresponds with the lesion received by the patient. From the coronoid process of the lower jaw a fragment measuring about three quarters of an inch in length was removed. This fragment in the patient's case might have been fractured, and subsequently reunited.

The track of the opening now passes obliquely beneath the zygomatic arch, encroaching equally upon all its walls.

In fact, it entirely occupies this space; the posterior wall of the antrum being partially excavated at the front, the whole orbitar portion of the sphenoid bone being removed behind, as also the anterior part of the squamous portion of the temporal bone, and the internal surface of the zygoma and malar bone laterally. In the orbit, the sphenoid bone, part of the superior maxillary below, and a large part of the frontal above, are cut away, and with these fragments much of the spheno-maxillary fissure, leaving, however, the optic foramen intact about a quarter of an inch to the inside of the track of the bar.

The base of the skull upon the inside of the cranium presents a circular hole of an inch and a quarter in diameter, and such as may be described by a pair of compasses one leg of which is placed upon the lesser wing of the sphenoid bone at an eighth of an inch from its extremity, the other half an inch outside the internal optic foramen, cutting the frontal, temporal, and sphenoid bones.

The calvaria is perforated by a hole, two thirds of which is upon the left and one third upon the right of the median line, its posterior border being quite near the coronal suture. The iron freely traverses the oblique track thus described.

It is obvious that a considerable portion of the brain must have been carried away; that while a portion of its lateral substance may have remained intact, the whole central part of the left anterior lobe and the front of the sphenoidal or middle lobe must have been lacerated and destroyed. This loss of substance would also lay open the anterior extremity of the left lateral ventricle; and the iron in emerging from above must have largely impinged upon the right cerebral lobe, lacerating the falx and the longitudinal sinus. Yet the optic nerve remained unbroken in the narrow interval between the iron and the inner wall of the orbit. The eye, forcibly thrust forward at the moment of the passage, might have

receded into its socket, from which it was again somewhat protruded during the subsequent inflammation.

It is fair to suppose that the polished conical extremity of the iron, which first entered the cavity of the cranium, prepared the way for the thick cylindrical bar which followed; and that the point of the bar, in reaching and largely breaking open the vault of the cranium, afforded an ample egress for the cerebral substance, thus preventing compression of the remainder.

Yet it is difficult to admit that a passage could have been thus violently forced through without a certain comminution of the base of the skull driven inwards upon the cranial cavity.

Little need be said of the physiological possibility of this history. It is well known that a considerable portion of the brain has been in some cases abstracted without impairing its functions. Atrophy of an entire cerebral hemisphere has also been recorded.

But the remarkable features of the present case lie not only in the loss of cerebral substance, but also in the singular chance which exempted the brain from either concussion or compression; which guided the enormous missile exactly in the direction of its axis, and which averted the dangers of subsequent inflammation. An entire lung is often disabled by disease; but I believe there is no parallel to the case in the Hunterian collection of a lung and thorax violently transfixed by the shaft of a carriage.

Taking all the circumstances into consideration, it may be doubted whether the present is not the most remarkable history of injury to the brain which has been recorded.[1]

[1] The iron bar has been deposited in the museum of the Medical School of Harvard University, where it may be seen, together with a cast of the patient's head.

DESCRIPTION OF THE PLATE.

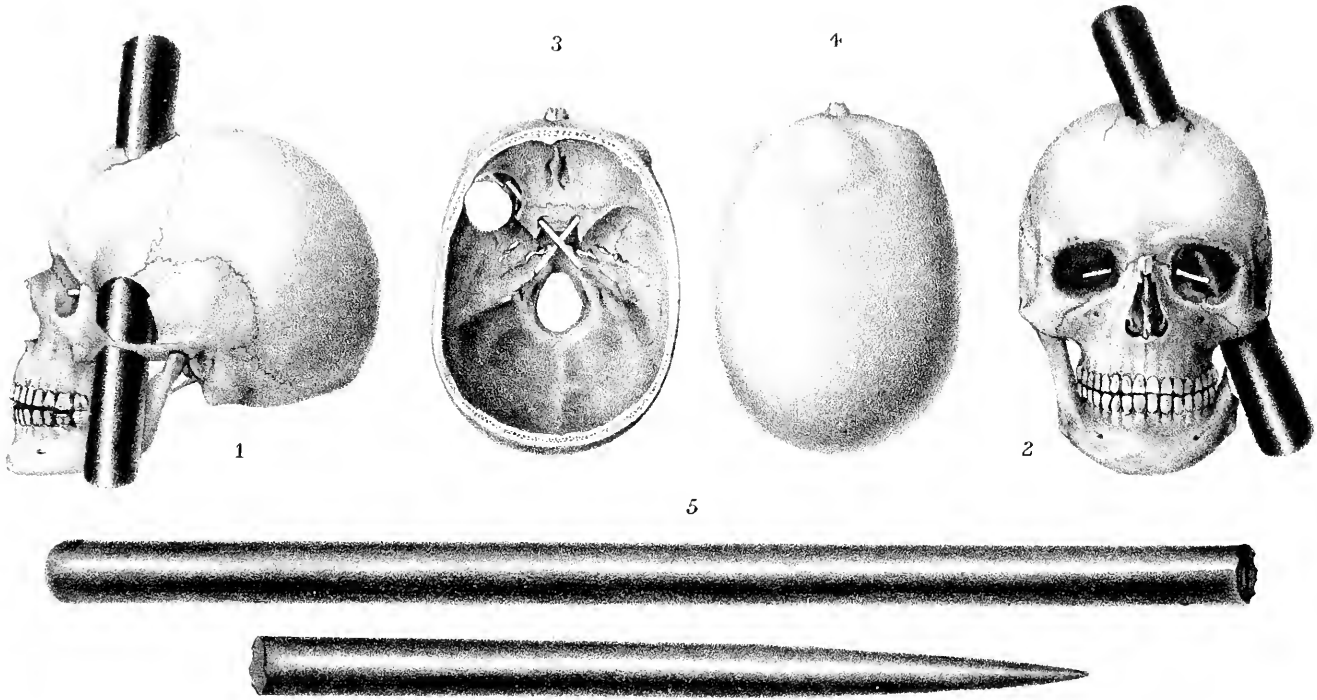
1. Lateral view of a prepared cranium, representing the iron bar in the act of traversing its cavity.

2. Front view of the same.

3. Plan of the base seen from within. (In these three figures the optic foramina are seen to be intact, and occupied by small white rods. In the first two figures, no attempt has been made to represent the elevation of the large anterior fragment, which must have been more considerable than is here shown.)

4. Cast taken from the shaved head of the patient, and representing the present appearance of the fracture; the anterior fragment being considerably elevated in the profile view.

5. The iron bar of length and diameter proportioned to the size of the other figures.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EMPLOYMENT OF A NEW AGENT IN THE TREATMENT OF STRICTURES OF THE URETHRA.[1]

This method consists essentially in the use of gutta percha in taking the impression of a stricture; and also avails itself of the plasticity of this gum in dilating the stricture.[2]

There is, in general, no great difficulty in the treatment of a stricture near the orifice of the urethra. On the other hand, a contraction of the canal far back towards the perineum often presents serious difficulties. The introduction of an instrument is then sometimes impracticable, or requires a tedious and very careful manipulation. It is plain that one great difficulty exists in the inability on the part of the surgeon to ascertain the precise character of the lesion, — the geography of the part to be traversed by the bougie. It is well known that this contraction is susceptible of infinite variation. It is abrupt or gradual, concentric or lateral, straight, angular, curved or spiral, smooth or knobbed, long or short, and finally partial or exaggerated; and against all these varieties the principal weapon in the hands of the surgeon is the bougie. This instrument, with little available variety, either in its material or conformation, has a point attenuated or obtuse, urged by a force applied at perhaps six inches' distance; and is expected to thread its way along the complicated and winding laby-

[1] Boston Medical and Surgical Journal, February 7, 1849.

[2] The use of gutta percha bougies is not new; it is attributed to a physician at Singapore; but I have neither seen nor heard any allusion to their being employed to take impressions of strictures, which, so far as I can judge, constitutes their chief if not their only value.

rinth which often constitutes a stricture. Fortunately, the healthy canal traversed by the bougie generally so directs it that, when the contraction is not great, the point enters its orifice after more or less manipulation. Yet it will be conceded that this manipulation, however delicate and skilful, is often, and of necessity, only a series of tentative thrusts or offers, made in the dark, in the hope of ultimately discovering and traversing some interval or interstice should such exist.

Other circumstances, such as the density and character of the opposing tissue, and the necessity of employing or of avoiding protracted pressure, complicate the problem.

The common method, it is true, is often quite effectual and satisfactory; especially in the ordinary run of cases of simple or partial contraction. Yet there is something gross in it. It is wanting in the nicer modifications of art which should characterize surgical manipulation, when they do not interfere with its simplicity. Nor are the results of this process always beneficial, especially when the case is difficult, or the operator inexpert. It will soon be shown that false passage is very common in connection with old stricture; simply because the propelled instrument, finding no natural canal, has made one for itself. Or, as not unfrequently occurs, when the urine merely dribbles away, no canal can be detected and no instrument of dilatation passed.

These difficulties are not new. Different methods have been devised to bring the part to be operated upon more directly in contact with the senses of the operator; such as a lamp to illuminate the stricture, and a tube by which to see it. Ducamp insisted upon the great advantage of impressions in wax, as conveying an idea of the conformation of a stricture, and contrived hollow tubes, containing eccentric bougies sliding out like a telescope at one side of the distorted canal.

Whoever has tried this wax has probably found that, however good the impression received in the interior of the passage may be, it is lost either when the material is extricated from the stricture or subsequently from the urethra. It is of questionable utility in this point of view. Besides, the wax is soft and liable to break; and lastly, when moulded to the shape of the canal, it is itself of no use in dilating it, and another instrument of corresponding outline must be arranged for this purpose.

The advantages of gutta percha are, first, that it is probably the only material in the world capable of receiving a sharp impression at a temperature quite comfortable to the skin, and at the same time of retaining it entirely at about the actual temperature of the body, afterward becoming hard and resisting, and exceedingly tough, even in attenuated filaments. It follows that, upon being withdrawn from the urethra, it presents a perfect impression of the most minute inequalities of the callous tissue against which it has impinged.

In the second place, it may be used when thus moulded as a dilator of the stricture; and it can be made to enter with unerring certainty any of its orifices.

A few words will suffice to describe the method I have adopted in employing these bougies. A medium size answers a good purpose, unless there be strictures anterior to the one to be treated, in which case a small calibre is sometimes requisite. Let the bougie be oiled and the tip passed to and fro rapidly in the edge of the flame of a candle until it is so warm that the nail will indent it; the mass will remain plastic after the surface has ceased to be hot, and, being very smooth and pliable, may be rapidly passed down to the stricture. If it be pressed against the stricture for a minute with a force equivalent to an ounce or two of weight, and then left to cool during the succeeding three or four minutes,

it will present, when slowly and carefully disengaged from the stricture, a firm and unyielding impression of the most minute inequality and indentations of the callous surface. The tip may be cut off and preserved, furnishing, with others, a complete history of the conformation of the stricture under treatment.

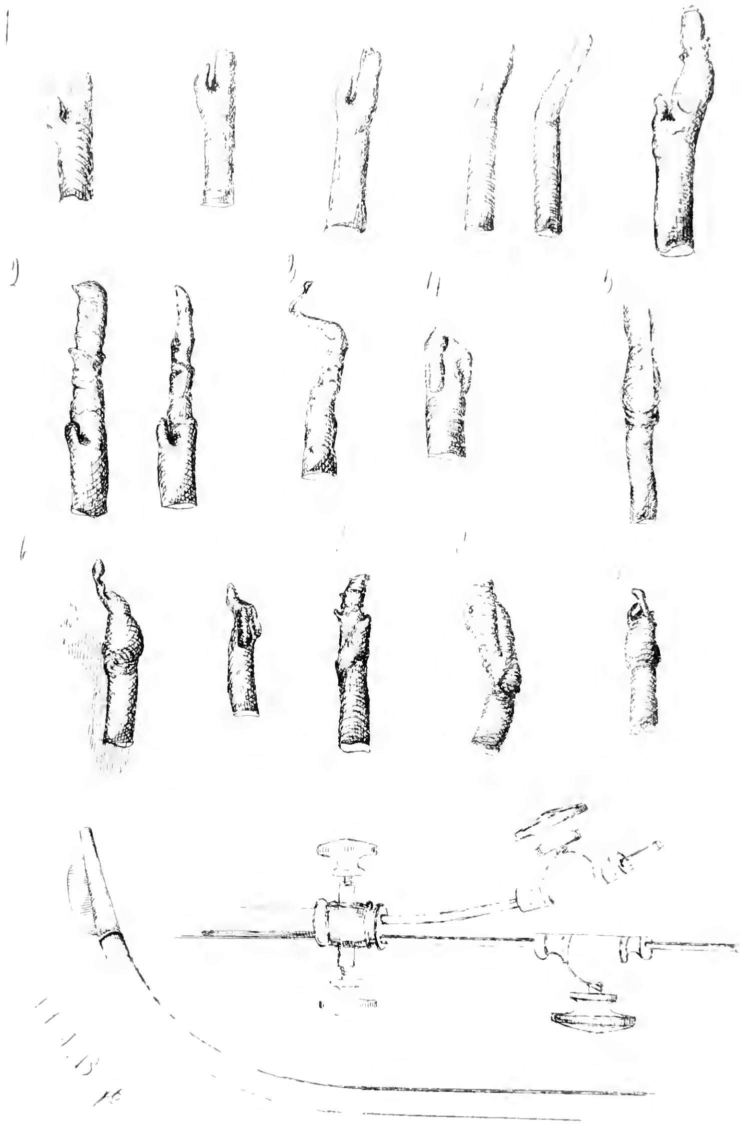
If water be employed to heat the gum, it will be found that the steam from the surface will soften the rod for the length of an inch or more; rendering it liable to curl up against the stricture, as small elastic bougies are apt to do. The tip alone should be softened. On the other hand, care should be taken not to burn the gum; as its texture and ability to harden are thus destroyed, and a piece may be left in the stricture. Such a case occurred to me. A plug, in one case, was thus left in a small stricture, causing retention during eighteen hours; when, the orifice having become dilated, the plug was forced out by the urine, which then flowed more freely than for many months before.

Pure gutta percha softens most readily, and cools with least elacticity and shrinking. It is therefore far better for impressions than when adulterated, as is common with caoutchouc. But when pure, a little oiling and use soon raise a fur upon its surface; so that it is probable that some compound will answer better for mere bougies.

I have hitherto made these bougies from pure gum, of the thickness of sole leather, cut into square strips, plunged into boiling water, and rolled between two boards, care being taken to prevent twisting.

When the bougie is embedded in the stricture, let its head, or external end, be warmed and flattened in a vertical or transverse direction with reference to the pubes, and it will indicate, when withdrawn, the position of the inequalities in regard to the periphery of the canal.

Suppose, now, that the impression, as is frequently the



case, is forked. Examination of the extremities often indicates which is the true passage and which the false; or if not, the larger is generally the true passage. Let the false extremity be carefully shaved off and the bougie returned into the urethra, its flattened head maintaining its relative position to the pubes. It forms a conical bougie of the best description, exactly adapted to the form of the true passage, which it inevitably enters. Impressions also record and especially direct the progress of a cutting instrument, as seen in the accompanying sketches.

The general pathology of stricture is not here discussed; but it will be quite obvious that there are cases of irritable and inflammatory stricture in which this method of dilatation, as well as all other active mechanical treatment, would be inappropriate. Nor are the relative merits of dilatation, incision, and cauterization considered. Each is occasionally a valuable resource; the success of all is incalculably aided by the knowledge derived from impressions; while the first, by far the most valuable mode of treatment, is considerably accelerated by the actual employment of the gutta percha.

A few sketches will give an idea of the character of the impressions. They are selected from a considerable number, to illustrate several points.

The first line of the annexed print presents impressions with false passages, taken in the course of the treatment of the first case detailed below. The first three figures represent different impressions taken early in the treatment. The fourth and fifth represent the bougies used as dilators after the impression of the false passage was removed; and the last figure shows the impression when the canal was easily pervious to a moderate-sized bougie.

The figures numbered 2 are different impressions of another stricture at different periods of treatment. Number 3

is an old stricture, nearly impervious, from a patient who died of inflammation of the membranous portion of the urethra. Numbers 4 and 5 are impressions of incisions. These incisions were made with Ratier's instrument, sketched below in this connection, and which is by far the best of a number I have employed. The blade slides back obliquely into the canula. Number 6 is an excellent impression of an old stricture. Two perfectly similar impressions were taken upon succeeding days, indicating that no doubt could exist of the character of its outline. The stricture was incised exactly at the point calculated, the parallel lines indicating where the impression of the two incisions seen in the small figure corresponds with the original impression. Number 8 represents the last impression of these and subsequent incisions, three days after which the canal was entirely pervious. These are from the second case detailed below. Numbers 7 and 9 are given as good impressions of curious strictures.

The following are two cases of bad strictures, which had resisted previous treatment. I believe the success attending their ultimate treatment to be due to the assistance derived from the gutta percha. They are here detailed as the first cases subjected to this treatment, and they were examined by various professional gentlemen from different parts of the country who happened to visit the Hospital during the summer of 1848, and an account of them was read to the Boston Society for Medical Improvement soon after their occurrence.

Obstinate Traumatic Stricture, with Fistula behind Scrotum. —— ——, æt. 38. Patient has had gonorrhœa many times, — the last time four years ago. In 1832, after exposure to cold and wet, great difficulty in micturition. Again, in 1837, a similar attack.

June 1, 1848. — Eighteen months ago fell astride of the rail of a ship; was made insensible, and afterwards had much difficulty in urinating, and passed bloody urine. Last July, after micturition, a swelling formed in perineum, just behind scrotum, which opened externally, and through the opening pus and urine escaped together. Urine has flowed more or less in this way since.

Now, penis and scrotum swollen; the scrotum quite dense, firm, enlarged and thickened, especially at posterior part.

Just behind the scrotum is a small red eminence which marks the entrance of a fistula, from which urine drops at every micturition.

The smallest sized catheter passes through a stricture just in front of the scrotum, but is arrested about two and a half inches farther on by a stricture into which it passes about half an inch.

Has had much fruitless treatment with instruments before entering the Hospital, and is sure none have ever entered bladder until about a month ago, when a small steel wire was passed twice or three times by the patient himself, which was followed by much constitutional irritation.

Patient states that he is unable now to discover this canal, to which chance directed the instrument. In the course of several explorations, I succeeded in passing the wire once; but the mass was dense and cartilaginous to the touch, and it was evident that nothing could be gained except by consecutive dilatation, which it was impossible to adopt, on account of the uncertainty of entering the stricture without protracted and irritating manipulation. This was a stricture of the worst class, a long and dense cicatrix, complicated both with a false passage at its entrance which was liable to engage the bougie, and with an old fistulous sinus.

June 3. — An impression of the stricture was taken with engravers' wax; but this being unsatisfactory in its indica-

tions, the gutta percha was tried the next day, and yielded, from the orifice of the stricture, one of the first three impressions of which a sketch is given in the plate. In the course of the week, as the patient was able to bear the treatment, the false spur was removed from the bougie, as shown in the sketch, and the rod, guided by the flattened head, was passed into the true canal.

On the 16th, by the same guide, incisions were made with Ratier's instrument; and on the 23d, three weeks from the beginning of treatment, a small silver catheter was easily passed into the bladder and left there.

July 6, the patient was able to retain a medium-sized flexible bougie for an hour or two without pain.

July 15. — "Now introduces, and wears with ease, a No. 11 flexible catheter." The last impression is shown in the plate.

At this time he suffered from a severe constitutional attack. Pain in the scrotum, with swelling, general heat, pulse 100, tongue furred. On the second day, anorexia and nausea, pulse 116. Not relieved by an emetic. On the third day, pulse 160, much nausea. Being unable to discover other local difficulty, after careful exploration of the viscera and functions, and the patient looking badly, I determined to divide the scrotum on its posterior aspect, which was done. The patient being etherized and placed as for lithotomy, and with the valuable assistance of Dr. Townsend, a grooved staff was passed into the bladder, and an incision about three and a half or four inches long was made in the perineum, through the thickened callus, until, at the depth of nearly three inches, the sound was exposed and the urethra divided to some extent, and nearly as far as the bladder, for the purpose of including, if possible, the internal orifice of the old fistula. The source of the constitutional trouble appeared in a small collection of pus in the

centre of the callus and quite near the urethra. During the three succeeding days the pulse was successively 128, 120, 90, with returning appetite and corresponding improvement in appearance.

From this time the patient steadily improved. Ointments, fomentations and poultices, compression and bandages, were applied as indicated, the patient soon taking into his own hands the treatment by bougies, of which he wore or passed with ease the larger sizes, until in November the urine flowed in a good stream, with a drop or two from the perineum once in two or three days. The patient left the Hospital at the end of the year, with a bougie to gage occasionally the calibre of his urethra, and much gratified with his improved condition.

Stricture of the Cavernous Portion, with Fistula. —— ——, æt. 72. "Reports that after exposure to cold eleven years ago stricture was first troublesome. A year ago, after another severe exposure, stricture again annoyed him, and he was treated with bougies. Five months ago suffered from retention of urine, and at this time a fistula formed behind the stricture, through which most of the urine has since escaped."

September 20, 1848. — "A fistula exists at the right side of the scrotum, of considerable size. Urine passes chiefly through this passage."

September 21. — "A gutta percha bougie was passed, which retained, on being withdrawn, the perfect form of the stricture."

This impression, numbered 6 in the plate, was twice taken at the interval of two days, leaving no doubt of its accuracy. It exhibits a minute prolongation like the head of a snake, and indicates an almost complete obliteration of the canal.

From this period till the end of the month the stricture was several times incised, and a number of impressions

taken, the first of which, with two incisions, is represented at No. 6 *bis*, while the last is given at No. 8, showing how large a calibre the canal had then attained. The stream of urine was now tolerably free, while the dribbling of the fistula had decreased, but, the canal being somewhat sore at the incised portion, I forbore to pass an instrument into the bladder. A few days afterward, my friend Dr. Warren, Jr., who at this time succeeded me in the charge of the ward, informed me that an instrument had readily passed the former strictures into the bladder.

In the course of three weeks the patient left the hospital with a canal of good diameter, and provided with a flexible bougie for his own use. The fistula was not entirely healed, yet no urine passed by it.

It is well known that old fistulæ in the urethra rarely heal, but they are comparatively harmless. On the other hand, the stricture which accompanies and produces them is capable of causing infinite mischief. An instance of this occurred to me while the above cases were under treatment.

A patient about forty-five years of age, had a stricture of a number of years standing. Exposure aggravated it, and caused retention. The urethra burst behind the scrotum, and when I saw him, on the fifth day, the penis and scrotum were tumefied and gangrenous. A little œdema only existed about and above Poupart's ligament; yet I deemed it advisable to incise, not only the former regions, but also the integuments of the abdomen on both sides. Much urine escaped from the scrotum and cellular tissue of the penis, while that of the abdomen appeared healthy throughout the course of an oblique incision in each iliac region three or four inches in length, and as deep as the tendon of the external oblique. A few days sufficed to show that here also the cellular membrane beneath the superficial fascia was

infiltrated with urine, for an apron of slough was soon formed between skin and muscle, as high as the navel and laterally backward, discharging pus with urine profusely, and the patient succumbed on the seventeenth day.

All of these were cases of obstinate stricture of long duration. Two had undergone protracted treatment without success, one of them in two hospitals; and, inasmuch as patients with old strictures usually get to be in some measure connoisseurs of local treatment, their voluntary attestations may be considered as having some weight in favor of the facility and efficacy of the treatment by gutta percha.

NOTES FROM CLINICAL LECTURES ON SURGERY.[1]

November 11, 1850. — The present hour is allotted to the purposes of clinical instruction, to the consideration of cases of surgical disease in the details of their history, immediate antecedents, symptoms, and treatment. This is a mode of study which has been before spoken of, and is opposed to that abstract and general account of disease which is adopted by treatises. It is, indeed, the natural method of study; the order in which experience presents itself to the surgeon, and in which it should be made to present itself to every student of our science. There is no substitute for it. Yet we find that when two similar cases have offered themselves to previous observers, it has happened that something common to both has been drawn from them, and that a generalization has thus been made; and it would be obvious folly not to avail ourselves of the knowledge and teachings of those who have thus previously observed. Clinical study, therefore, proposes to itself, not only the examination of a detailed and isolated case, but also contemplates its relations with other similar cases. It investigates the eccentric biography of some particular instance of disease, with constant reference to the usual and common history of the same disease, gaging by this standard the irregularities, and endeavoring to reconcile to this standard the anomalies, of each recurring case. Our clinical study will be confined to the cases we have observed together during visits at the Massachusetts

[1] Boston Medical and Surgical Journal, November 20, 27, and December 4, 11, 25, 1850; January 29 and February 5, 1851.

General Hospital; an institution which has no superior, and which offers great facilities for the observation of surgical disease. It will be found, at the end of our term, that a very large proportion of the usual surgical affections have passed under our notice, and in the common relative frequency of their occurrence in the routine of daily practice. And let not the graver and striking cases claim too large a share of your attention; these are not the cases which you will meet with in your daily professional walks. But it is the minor and seemingly slight and trivial, — the chronic unchanging and unattractive lesions, which will fill the sphere of your daily avocations, and upon the management of which will depend your comfort and success. In addition to the surgical cases occurring at the Hospital, it will be my duty to notice the surgical operations there performed before the class; and this naturally leads to the consideration of the anæsthetics so constantly administered.

It is a little striking that those who are in the daily habit of administering anæsthetics for the slight operations of dentistry, or in midwifery, are often startled at the violent or seemingly dangerous symptoms which sometimes result from the administration of the dose required for protracted operations; but I believe that any one who shall have witnessed these effects during a brief period at the hospital, and who shall have learned their true relation to the anæsthetic state, especially in point of danger, will feel himself at home in administering the ether in any emergency whatever. I use common ether (sulphuric). Chloroform has killed people. There is sufficient evidence that patients in good health, to whom chloroform was administered in the ordinary way and with ordinary care, have become pulseless, dead, — suddenly and without warning. Such accident has either never happened with ether, or is excessively rare. Chloric ether — dilute chloroform — blisters the skin, which

requires abundant oil to protect it. So that, on the whole, common ether is safest, cleanest, simplest, and is indeed, apart from its odor, a perfect anæsthetic.

CASE I. *Exstrophy of the Bladder, etc.* — This unfortunate patient, although not from the Hospital, is accustomed to offer himself for examination here and elsewhere. I have seen but one other similar case. The first feature which strikes us is the red, raw, and inflamed mucous surface of the posterior wall of the bladder, which is protruded through an orifice in its anterior wall as large as a moderate-sized apple, and thence through the abdominal parietes. It is thus literally turned inside out, and exhibits the ureters dripping urine, and, below, two orifices, which the patient states to be, and I dare say are, the termination of the spermatic ducts. To complete this median division of the tissues, there is entire epispadias of the penis and of the gland; and the bones of the symphysis pubes gape to the extent of many inches. You will observe, besides, an inguinal hernia, produced very likely by a laxity of tendinous fibres which have no firm insertion.

This is an instance of the failure on the part of nature to unite the lateral masses of the body upon the median line, and bears analogy to certain other deformities, such as hypospadias, hare lip, and spina bifida. It is incurable.

CASE II. *Epithelial Disease of Lip.* — Commonly called cancer of the lip, and with good reason; for although the affection is by no means identical with cancer, yet it has practically many of its destructive properties. It affects the skin and subjacent cellular tissue, the mucous membrane, and the muscle. The man operated upon on Saturday was about fifty-two years of age, healthy, and of a fleshy make. Two years ago he discovered a pimple of the size of a small

pea on one side of the free edge of the under lip. A year ago this had attained a double size, and was covered on the buccal margin with a scab of ordinary appearance and of the size of a half-dime. This patient had been treated by some cancer doctor, as such lesions often are, with caustic, but ineffectually. I removed the mass by a V-shaped incision in the sound tissue, and the edges were approximated by three or four sutures. The great object here is completely to excise the disease; and if this is done, it has little tendency to return, differing in that respect from true cancer. Now the latter disease may affect the lip as well as other regions, and hence the importance of establishing distinctly the difference between the two diseases, that you may be able with confidence to assure your patient of his probable future. And first let us eliminate the advanced stages of this disease, where the bone is eroded and the glands are affected. In such cases extensive plastic operations are sometimes necessary. I have removed the entire lower lip, dissecting the cheeks back to the facial artery of each side, and uniting them when drawn forward upon the median line. In this instance the disease returned in the cicatrix a year afterward. Extensive ulceration and fungoid growth may alter the general appearance of the texture to a degree which renders its appearance equivocal without the aid of the microscope. But in its early stage the epithelial disease of the lip generally shows upon section a dense white opaque color, and often upon minute examination, as here, vertical striæ dividing it into apparent columns, which either terminate at the free labial edge, disintegrating into a paste which furnishes a scab, or rise above it to a considerable height. But the microscope leaves no doubt in the majority of cases. I will not say all cases; for though some observers have no question upon this point, I have not satisfied myself about it. In most specimens the field of the microscope, as in the present in-

stance, exhibits unequivocal epithelial features. The white caseous mass shows the normal epithelial cells and scales, every irregularity of the latter varying in size and shape, while the distorted cells often attain, with and without nuclei, enormous size. A careful observation also detects little groups of the minute cells in the first period of their growth.

Such is the common disease "cancer of the lip," beginning with a small purple crust or scab, and, if not removed in season, attaining an ulcerated growth which compromises the life of the individual; perfectly curable at first, but, if neglected or tampered with, getting beyond the reach of surgical art.

Case III. *Hare Lip.*—This boy, eight or nine years old, presenting the ordinary appearances of a bad single hare lip, was a patient of my friend Dr. Hayward. The fissure reached the left nostril, dividing also the hard and soft palate in the mouth. You observed that the division of the lip was a little to one side of the median line. It is always so, with very rare, if any, exceptions. The front teeth also often project, as here, where one had been recently removed. The edges were refreshed and brought together by sutures. We rarely use pins, though they were once thought essential. Sutures answer equally well, and are more convenient. The upper one should be carried well up into the nostril to prevent a gaping and ugly orifice at that point. It may be added, in respect of these sutures, however unscientific the avowal may be considered, that with a healthy patient and good atmosphere, sewing skin is much more like sewing cloth than is generally supposed. It is better to add stitches enough to adjust the parts exactly where nicety is required, than to omit them and trust this to nature. In the latter case, the gaping interstice gets filled with lymph, leaving a broad cicatrix, or an edge projects; so that altogether we

are less sure of the result than when the edges are everywhere nicely adjusted and brought together as has been described. I never saw an operation for hare lip which did not leave a slight notch or fold at the edge of the lip. In fact, the longitudinal contraction of the cicatrix would produce this, but you may avoid it almost entirely by paring the free edge well down to the orifice of the mouth; let the cut surfaces be concave rather than convex towards each other; and dissect up the flaps from the jaw enough, especially in infants, to abate the lateral traction. Finally, remove the stitches with the first trace of suppuration in their track, or you will have scars to mark their position. This operation of Dr. Hayward's will probably make an excellent lip. In regard to the cleft palate of this boy, where it is so wide, it is unfavorable for operation. I have produced, contrary to my expectation, a good union of the posterior portion, in a similar case, but the palate was afterwards hard and tense from the contraction which ensued upon the large lateral dissection necessary to loosen the scanty flaps. The cicatrix was very different from the pliant and serviceable palate which we often have after operation where the cleft is not so wide.

Case IV. *Removal of Cicatrix of Neck after Burn.* — Some of you have before seen this enormous cicatrix of the neck and breast. The patient was burned by the ignition of matches in his vest pocket. Last year I divided a bridle of the neck, and with real relief to the man. Why it did not again contract, it is difficult to say; but the fact is, that he could raise his chin considerably better for the operation. The whole matter of the contraction of cicatrices is uncertain. Some diminish almost to obliteration. Others remain loose and pliable without contraction. Lymph has doubtless much to do with it; but we generally cannot assign the direction of contraction. Some parts of this scar were exquisitely

and finely plicated: while other parts presented large welts, much like cheloides. One of these, about the size of a finger and the seat of troublesome suppuration, I removed on Saturday from the lateral hyoidal region. Such masses of cicatrix are usually of feeble vitality, but this was nourished by eight or ten small vessels, requiring ligature. The wound has gaped widely, and the motion of the head is free. Without overestimating the chances of relief, as the wound cannot contract to smaller dimensions than before, and as the fibrous and contracting lymph is entirely removed at this point, we have every hope for a repetition of the improvement which followed the previous operation.

CASE V. *Tertiary Syphilis. Ulcer behind the Left Leg on the Calf.* — This patient, a middle-aged, healthy man, had chancres fifteen years ago, and again in September, 1849, for which he treated himself, although subsequently he took pills for a long time from a physician. Two months after the primary sores, he had rheumatism of the right wrist and knuckles, and soon after scabs upon the hairy scalp, accompanied by the development of a discrete eruption of pimples elsewhere on the body. Some of these pimples became large, and covered with scabs. The left leg was subsequently the seat of a considerable ulceration, which attained the size of the palm of the hand. and was preceded by a subcutaneous tubercle. I will only remark of this case, that its progress is somewhat anomalous. The deeper forms of cutaneous eruption, the tuberculo-crustaceous eruption of transition from secondary to tertiary disease, and especially the tertiary ulcer of the skin, resulting from *tumeur gommeux*, usually belong to a later period of the affection than that at which they have been manifested in this case. It is hardly worth while to go back fifteen years for the primary affection, though a period even as long as twenty years has been

assigned as a prodrome of tertiary disease. There is reason to believe that the patient has undergone mercurial treatment, which may account for the absence of some of the usual forms of secondary affection. The view which has been adopted in relation to this case is confirmed by the rapid cicatrization of the ulcer under the specific treatment of tertiary disease, viz. the iodide of potassium in considerable doses, here increased slowly from five to ten and fifteen grains, three times a day, and for a length of time. The patient will soon be well.

November 16, 1850. Case I. *Traumatic Ectropion.* — A middle-aged man, in good health, stated that, nine years ago, he first perceived a small pimple upon the lower lid of the eye, which gradually increased until it had attained the size of a large pea. A few months ago it was treated with caustic by a quack, when the entire eye became inflamed to a degree resulting in its disorganization and in its adhesion to the remaining fragment of the lower lid. The lid is everted, and in this position suspended, tense, between the eyeball and cheek; the patient wearing a poultice over the whole, for the relief it affords him. In this case the ocular globe was incised for the purpose of allowing the escape of its useless contents, and in the hope of inducing by its atrophy a contraction and diminution of the exposed conjunctival surface. This was done by Dr. Hayward, whose patient he was.

Case II. *Inguinal Hernia. Treatment by Injection.*—This subject seems to possess some little general interest. The disease is common, and the surgeon is often applied to, to know how far it may be cured by injection. This method of treatment is not new. In his work on Operative Surgery, published in 1846, Dr. Pancoast states that he had employed it eleven years before that date. The operation consisted of

an injection into the hernial sac of a stimulating fluid, by means of a minute trocar and canula, to which a syringe was attached. This writer mentions Lugol's solution of iodine, or the tincture of cantharides, in quantity from half a dram to a dram, as the injections used. Neither is there anything new in attempts to obliterate the ring by adhesion or destruction of the sac. Such were, in the latter part of the last century, the ligature or excision of the sac and testis, by which "the Bishop of St. Papoul found that more than five hundred children had been castrated in his diocese"; and the *royal stitch*, which, embracing the sac, preserved the testis to fulfil its legitimate function of making subjects for the King; and, later, the operation which plugged the ring with a part of the scrotum, and that which irritated it with gelatine threads, or acupuncture, — as well as other devices, which have been for the most part abandoned.

The present patient, a young man of twenty-one, healthy and of good habits, has had a left inguinal hernia for three years. Within the last year he has worn a truss, the hernia, notwithstanding, being often troublesome and tender. It is now, when allowed to descend, an enterocele of the size of a goose egg, easily reducible, the ring readily admitting the middle finger; and under these circumstances the patient applied for a radical operation. I stated to him that the operation was not dangerous; that it probably would not cure him, though it might alleviate the inconvenience, perhaps greatly, perhaps not at all. The instrument used, which was made for me several years ago, consists of a minute silver syringe terminating in a fine tube. The latter carries at its point a perforated trocar, which serves at once to make the puncture and to deliver the injection. With this instrument, twenty-five drops of tincture of iodine were deposited at the ring itself, through a puncture in the skin made with a tenotomy knife. I will not undertake to

say that I injected the sac. When the sac is thin, I do not believe it possible to say whether the instrument enters the sac, or whether it pushes the sac before it. You may perhaps transfix it literally; but there must be, in general, an uncertainty whether the injection actually penetrates the sac, or only bathes its exterior; and practically the difference in producing inflammation, whether from contact or by continuity, can be of no great importance. The result of the operation may be considered as a question of theory and of fact. This process aims to obliterate or plug the ring by an effusion of adhesive lymph. Now the cause of hernia is a want of resistance in the tendon; and as we cannot make new tendon, the question is how far lymph is capable of supplying its place. Lymph is a plastic material, liable to great absorption, and having a tendency to yield to pressure. It has very little of the resisting property of tendon. Most patients are obliged to wear a truss after the operation for strangulated hernia, which creates a considerable effusion of lymph. The tendency of most irreducible herniæ, where the ring is plugged by its adhering contents, is to increase. But theory should never stand in the way of fact. If it were possible to get at a series of statistics of this operation, the result would be conclusive. But in the absence of these I will give the grounds for my own conclusions in respect to it.

I have operated in a number of cases, sometimes with relief, sometimes with none. In one case of a young child, the pressure of a light truss after the injection of ten drops of tincture of iodine, produced a small slough of the integuments.

I have been not unfrequently applied to, in common with other surgeons, by patients who had undergone the operation once, or even twice, to know what benefit would be likely to result from an additional operation.

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A maker of trusses informs me that he frequently receives applications for trusses from patients unsuccessfully operated on, or where the relief was only temporary. On the other hand, it is quite probable that lymph diminishes the size of the tendinous aperture in certain cases, and sometimes to a considerable degree. In fact I know patients thus operated upon several years ago, who believe that the liability to a descent of the hernia has been materially diminished, and who consider their condition improved by the operation, though they still wear a truss.

Now under these circumstances, if there be no great danger attending the operation, it is justifiable; and I never heard of a fatal result from it, though peritoneal inflammation is occasionally quite considerable. So that a patient who desires to undergo this operation, not dangerous in itself, for a chance of obtaining greater or less relief from an inconvenience, may be gratified.

CASE III. *Congenital Hypertrophy of the Middle Finger. Amputation.* — This extraordinary deformity occurred in a fine healthy young girl of sixteen. The finger is truly enormous, measuring five and one half inches in length and the same in circumference at its base. I removed the finger, and with it about three quarters of an inch of the head and shaft of the metacarpal bone.

CASE IV. *Pott's Disease of the Spine. Death.* — The boy whom we saw on Saturday, moribund, died in the course of the day. He has been for some weeks steadily getting worse, and within a few days quite helpless, sleeping most of the time except when roused. I have at all times refrained from minutely examining his back, as he was beyond the reach of art, and the great object was to make him comfortable. He entered the Hospital on the 10th of October

last, and his back at that time presented an angular curvature of about 115°, the prominent vertebræ being the third and fourth lumbar. This deformity showed itself, as the patient states, six years ago, but he has had no especial pain or disability till within a few weeks. Seven weeks ago a swelling upon the left side of the rectum broke, discharging pus. An abscess was also detected at the time of the patient's entrance, above the projecting vertebræ and to the right side, which opened spontaneously and with profuse discharge a week before death. There was also marked tenderness over the sixth and eighth dorsal vertebræ. It is a striking feature in this case, that so long a period should have elapsed between the original appearance of the deformity and the subsequent grave symptoms. This is unusual, but sometimes happens. To account for the recent and large secretion of pus, we may suppose either that the inflammatory action of disease, which had been for six years nearly stationary, was suddenly renewed, or that it had invaded the bodies of other vertebræ. The last hypothesis receives some confirmation from the position of the pus in the lumbar region, which was a little above the original lesion, not having gravitated as usual to a depending point below it; and also from the tenderness of the middle dorsal vertebræ. These, however, as yet presented no deformity; and both foci of the disease, if there were two, doubtless contributed to the supply of pus which was delivered at the fistulous openings; in the one case at the seat of the disease, in the other upon the lower part of the nates, having probably escaped from the cavity of the pelvis by the sciatic notch.

November 25, 1850. *Melicerous Cyst in Forehead. Operation.* — This patient, a healthy young man, about twenty-five years of age, and from the wards of Dr. Hayward, presented a tumor about the size of a horse-chestnut over the left eye-

brow. He stated that it had existed from birth, but that it had doubled its size within a few months. Upon examination, it proved to be moderately soft and fluctuating; and from its "feel," might have been a bag of fluid, or a common fatty tumor. And yet you could be tolerably sure of making a correct diagnosis in this case. In the first place, a sac of any other fluid than the caseous matter which this proved to contain is very rare in this locality. For example, a cyst in the cellular tissue containing pure serum, or glairy fluid, is quite rare. Neither is chronic abscess likely to exist from birth, or without some of the inflammatory symptoms which were wanting here. Fatty tumor, which is sometimes fluctuating, has generally a lobulated feeling somewhere, which this had not. I examined this patient carefully at my house before he entered the Hospital. There was a uniform fluctuating mass above the brow, bounded at its inner side by a remarkably long vertical ridge. Now several years ago I removed a similar congenital tumor from a child of three years of age, situated deep beneath the temporal muscle, and found it embedded in just this way in a depression which it had formed for itself in the temporal bone; so that these tumors, when congenital, may embed themselves at a very early period in the thin, soft adjacent bone, remaining, as in the present case, comparatively inactive for a number of years, and suddenly in a few months expanding so as entirely to outgrow their original accommodations. When a cyst thus rapidly increases, the enlargement in several that I have removed seemed to be from an increase of its serous rather than its solid contents. In this case it was not so. The whole material had increased in quantity.

Apart, however, from any peculiar features, encysted tumors are very common in this region; upon the lid, in the orbit, and about it; so that a tumor here, which presents nothing incompatible with the hypothesis, and which suggests

no other especial growth, may be fairly set down as of this character.

By "encysted tumors," I mean a distinct bag or cyst, containing this peculiar caseous, soft white material. Serous cysts (if we except "hydrocele of the neck") are excessively rare; cysts containing glairy fluid (if we except the bursæ) still more so. Nor should the term "encysted" be applied to those hard or fatty tumors which happen to get surrounded by a little condensed cellular tissue, from which they "peel out." The true "encysted tumor" is very common, and, being quite distinct from other growths, should have a monopoly of the name. It is said to contain either *atheroma* or *meliceris*, — very ancient words, which often convey no distinct idea. Yet these terms are really very descriptive of the qualities of their contents, the former signifying *pap*, the latter *honey-wax;* by which is meant, I believe, not clear honey, but chilled or frozen honey, which it greatly resembles. They are in pathology nearly identical; but *atheroma* readily mingles with water; *meliceris* is waxy, sebaceous, or oily, and sheds water. *Atheroma* is a watery fluid, filled with little plates or fragments of epidermic material, sometimes as large as grains of rice, and of a semi-translucent white. Under the microscope it shows numberless epithelial scales, of which these masses are composed; sometimes nucleated, sometimes not, and often very irregular. In *meliceris*, on the other hand, though there may be serum present in small quantity, yet the cells adhere to each other by a tenacious sebaceous matter, or concrete oil, and in at least four among the tumors of this sort which I have removed, and of which I have retained a careful microscopic record, there were no scales, but in their stead beautiful translucent oval cells, a few of them nucleated; and occasionally, as a few in this case did, presenting irregularities in form, and some being of minute size. Their usual diameter is rather

less than that of an epithelial scale, and they are seen embedded in and inseparable from the granular sebaceous oily mass when the field is filled with water; but substitute oil for the water between the glasses, and these granules are at once dissolved, the cells coming out clear and clean into the field, and being the most truly beautiful cells I have ever met with among morbid growths. They are almost hyaline, and may be rolled about like little bladders. In one case they partially collapsed upon the contact of oil, as by an instantaneous exosmose. The gross mass looks like lard at ordinary temperatures, and is sticky and greasy to the touch.

The cyst of meliceris and atheroma is sometimes lined with a beautiful epithelium. Sometimes the epithelium is irregular and rough. In two cases of *meliceris*, at least, the epithelial lining was only partial, the rest of the surface being moist and divested of integument. This last character may perhaps have some influence in determining the quality of the secretion; whether watery, or sebaceous and waxy; whether epithelial scales, or those large and beautiful epithelial cells.

These cysts sometimes attain great size. I have one that I removed from the shoulder which held a large tumblerful of atheroma. Sometimes they point and burst, subsequent inflammation then obliterating the sac, or it remains open. But usually the whole sac requires extirpation, as in this case, where, after puncture, the sac was dissected out by Dr. Hayward. A small portion when left is sometimes obliterated, but sometimes gives rise to new secretion; so that it is better in operating to wait for the bleeding to cease, and to explore the wound for the whole sac; especially in the lid, where the bleeding at first obscures everything. About the orbit these growths are very liable to be adherent to the bone; and congenital tumors thus situated have, in several cases

which I have recorded, proved meliceric and not atheromatous. Of their cause, we know nothing. Astley Cooper thought that they were obstructed sebaceous follicles. Lebert states that they contain all the products of these follicles. This they certainly do, and often, in addition, hair, either free or attached; but they are occasionally deep, and seem to me to have also other analogies than those offered by the sebaceous follicle.

CASES II. and III. *Hydrocele. Radical Operation.* — These two cases were average instances of the disease; being each about the size of a small fist, elongated in their vertical diameter. As to establishing a diagnosis from the external outline, pear-shaped or other, which these accumulations of fluid present, it is very uncertain. Their great test is translucency. A common hydrocele is translucent. These were perfectly so. When I first examined the elder of these patients, I felt a distinct series of irregularities upon the posterior surface of the sac, like indurated veins of varix, or some other unfrequent accompaniment of the affection; but transmission of light showed that there was no varix, and that the convoluted sensation was only accidental and in the fibrous parietes. These things are sometimes very deceptive. I once treated a perfectly hard and knobbed string of tumors upon the cord by leeches, there being some pain, and as I had no doubt of their solid character. There was no approach to fluctuation. As a mere experiment, when I saw the patient again I placed a lamp behind them, and they proved to be perfectly transparent, constituting "hydrocele of the cord," the unobliterated tube which the testis drags after it to the scrotum. To examine properly, you should grasp the scrotum behind, and, drawing the skin tense over the tumor, look through your hand, or a roll of paper, or a stethoscope placed upon the shaded side while the other is illuminated by

a lamp, or, what is better, by strong sunlight. And it should be borne in mind that pus, or bloody fluid, or walls greatly thickened with lymph, are not unfrequent and are opaque. They must be judged from other evidence. You may have noticed that in the elder of these patients the testis seemed to be a distinct mass appended to the bottom of the tumor, instead of being, as usual, embedded behind it, and from a quarter to a third of the way up. This was probably from an accidental adhesion of the tunica vaginalis to the front of the testis, which prevented the sac from being distended downwards and forwards.

The history of these two cases illustrates well the varying progress of the disease. The affection of the middle-aged seaman dates from twelve years, and has never been operated upon. That of the young man of twenty-one is of only three years' duration, and I have drawn the water from it twice before. The contents of the former are a pale thin serum, becoming only cloudy upon the addition of nitric acid; of the latter, a thicker bright yellow fluid, containing abundant albumen, the whole being stiffened as you see by the acid.

It is unnecessary to speak of the numerous methods of exciting inflammation and the exudation of lymph with a view to the obliteration of the cavity. Port wine with water, which sometimes produces sloughs of the cellular tissue, has been pretty generally abandoned for tincture of iodine, which does not. I have often seen Velpeau fill the sac with water containing one third tincture of iodine. It was rubbed about in the sac until it occasioned pain, and then allowed to escape. Another way, and that which I adopted in these cases, is to inject a dram of tincture of iodine in two or three drams of water, and to leave the whole in the sac for absorption. This method seems to be as effectual and safe as any other for the average cases of the affection in adults. You observed that it excited, as often happens, considerable

pain in the course of the cord and in the loins, especially in the case of longer standing, where the water had never been drawn off. The testis will probably swell, perhaps largely; flocculent serum will be effused into the sac, as into the thorax in pleurisy, and when absorbed will leave corresponding adhesions of the organizable parts of the albumen, which is the object of the operation.

Case IV. — In the corner of the east male ward you saw on Saturday a patient, an otherwise robust mechanic, aged twenty-four, with a remarkable tumor in the left groin; a deep-seated mass as large as the two fists, rising considerably above the surface, its base measuring five by six inches, and surmounted with abundant convoluted veins. The leg of that side was also very large, the calf measuring four inches more in circumference than the right. The whole surface of this leg is purple, with dilated venous capillaries, and upon the external aspect varicose veins, with several considerable ulcers of the leg, probably resulting from them. This excessive œdema, the varix and ulceration, are doubtless the result of compression of the veins at the groin, as the mass lies directly upon them, involving Poupart's ligament. From his account, the patient first discovered a small tumor in the groin four years ago, and at the same time swelling in the leg, both of which have slowly increased; yet he kept at work until the ulcers appeared four months since.

What is the character of this tumor? Upon its surface is a large and solid handful of varix, easily compressed, and leaving no doubt of its character. Beneath this is a mass of lumps, some adherent to each other, others movable, and varying from the size of a kidney bean to that of an English walnut. These are doubtless enlarged glands. Exploring the inguinal ring, we find it free from hernial protrusion. The saphenous opening, as far as we can reach it through

the swelled integuments, is equally free from crural hernia. This tumor lacks the thrill and the pulsation of aneurism, of which enlarged glands are no regular feature. There is neither elasticity nor any lesion elsewhere to lead us to suspect chronic abscess. It is not a fatty tumor. The fibro-albuminous or sarcomatous tumor I have never known to infect the neighboring glands. There is no acute inflammation. Probability then settles between the alternative either of a disease which does tend to affect the glands, or an idiopathic affection of the glands themselves. It has occurred to me whether some diseased enlargement of the leg may have infected these glands; but I know of no such disease, nor is there here any circumscribed affection in the leg or thigh, which moreover has grown much smaller for bandaging, while the ulcers have nearly healed. The groin is probably the seat of the original lesion, and the swelled leg an effect of it. Now cancer in its various forms infects the glands as a primary disease, or is secondarily absorbed into them from the neighborhood; and this is not a very uncommon place for it. I have seen three cases in the groin which I supposed cancer, in one of which it arose from the femur near its head. But in those cases there was a principal central lesion to which the glands seemed to be satellites. Here we have a confused mass of glands more or less distinct, as far in as we can feel them, and no principal mass till we get very deep. There is also less tendency to mutual adhesion than I should think common in glands which have absorbed cancerous cells.

Idiopathic cancer of an absorbent gland itself, in three cases I have seen, in the neck, inside of the elbow, and in the groin, was more confined to the single affected gland, which grew to the size of a goose egg and larger, while the neighboring glands were but slightly enlarged, if at all. So that this tumor wants some of the usual features of malig-

nant disease. On the other hand, what is called "chronic inflammation of the glands" does present a very similar chain of tumors. They often occur in the neck, and on section exhibit the enlarged and red gland beautifully spotted or divided with patches of dense opaque, straw-colored lymph, infiltrated into its tissue. I have never identified glands in the groin, — as I have in the neck where they are occasionally extirpated, — except as scrofulous abscess, after they have become fused and suppurated, in which state they are brought to the surgeon.

I think we may be satisfied that this tumor comes into one of these two categories; but I believe it to be impossible at present to decide which. We shall doubtless know more about it from its future manifestations. In the mean time, the leg has been bandaged and placed at rest in a horizontal position, with great relief and diminution in size. For the present, iodine will be administered internally, and cautiously applied externally.

DECEMBER 2, 1850. — CASE I. *Fistula in Ano. Operation.* — This patient experienced, according to the history of his affection, a longer interval than is common between the first appearance and the discharge of the abscess. It developed spontaneously by the side of the rectum two years ago, and at the expiration of two months projected an inch or more before breaking. It is often asked whether an abscess in this region leads necessarily to what is called fistula in ano; or, in other words, whether an abscess may exist here without the usual tendencies of this troublesome affection. You will find in the books that a spontaneous cure is excessively rare. I have seen one such case; but I incline to believe that there are surgeons of larger experience who may not happen to have seen even one. It was in a young man in whom a tender induration at the outer mar-

gin of the sphincter broke about the third day. The probe entered three quarters of an inch, but the excessive tenderness of the part caused the operation to be deferred, and the opening healed by the fifth day after. This occurred at least two years before the use of ether, and the patient has had no trouble since. Such a case is rare, and an abscess by the side of the rectum generally requires the operation for, and practically is, "fistula." If we adopt Brodie's view, that this abscess is always caused and perpetuated by the escape of fæces through a little ulcer of the mucous membrane lining the sphincter, we have a constant and peculiar condition connected with it which prevents its spontaneous cure. Brodie thinks this is the cause of their duration, rather than the friction and motion of the sphincter and levator; and, as a natural result, urges the necessity of finding this internal perforation, and of making the incision through it in order to obliterate it. Against these views of this most distinguished authority it may be alleged that a surgeon is generally called upon to operate without the "three or four examinations" which he finds to be sometimes necessary for the discovery of the internal orifice; and that in the event of not finding it it is common to perforate the mucous membrane with an artificial opening, and that such cases usually get perfectly well. In this case the internal orifice was readily found at its usual place about half an inch above the external sphincter. A few days ago, in another case, I found the ulcerated orifice in a less common position, at the extreme head of the sinus and of the sphincter, and opening into the dilated gut above. The usual position of the internal fistula indicating the place for exploration, and the hole being found and the incision made, it remains to be settled what is to be done with the upper part of the sinus, which, as in this case, often runs an inch higher up. Brodie advises that it be left. This one I slit with scissors to the extent of half an

inch, as it was deep, and there was no especial reason for not placing it in the category of other sinuses. In fact, it is common to divide such a sinus with caution. There is a chance of hemorrhage from vessels you cannot reach. But when the wall is thin, you may feel, with the finger in the anus, the hemorrhoidal arteries beating in its substance, and avoid them. There were none here; but in a case a year ago, where such a vessel was high up, directly below the upper orifice, I passed a wire of pure silver, which will twist without breaking, through the latter, and let it cut its way out. Then there are not unfrequently sinuses outside, extending laterally upon the nates, sometimes to the tuberosity, or in front to the scrotum. A recent or inflamed one may be left to itself, the sphincter being divided: but a chronic or indurated one had better be laid open, as in the present case, where such a sinus, opened by the patient himself with a penknife, had been frequently touched with caustic and become greatly indurated. The patient, who seems to have studied the subject, desired that it should be dissected out; but it will now doubtless granulate on exposure to the air. The operation, apart from the chance of hemorrhage, is, as you saw, inconsiderable. A finger in the anus meets, at the inner fistula, a probe passed into the sinus. Now you may follow the probe with a narrow blunt-pointed knife, and make it cut its way out, resting on the tip of your finger; or, what is easier, and as I did in this case, drag down the tip of the probe or director through the anus, and slide it over upon the opposite side of the nates. The mass is then exposed, lying upon your instrument, and you divide it as you please. A little dry lint separates the cut surfaces for a day or two while they have a tendency to unite, and the wound afterwards requires only to be kept clean. This patient will doubtless get about in the course of a fortnight.

CASE II. *Injury of Finger. Amputation.* — A middle-aged woman, otherwise healthy, two years ago washed her finger, which was slightly pricked, in soapsuds containing bedbug poison. The finger swelled largely; of which the rational explanation probably is to be found, not in any specific action of a mineral or vegetable poison, but in an aggravation of some pre-existing tendency to inflammation. The patient applied to a doctress "good in such cases," who opened an abscess with scissors and poured into it alcohol.

After a considerable interval, the finger came under proper treatment in the hands of a surgeon, and was healed, its two extreme joints remaining stiff. This unfortunate member was again accidentally laid open and the bone fractured by a blow a fortnight since. The tissue of the old cicatrix ulcerating, as it easily does, the parts assumed the appearance of a whitlow. Dr. Townsend amputated the finger at the middle joint, making a very neat flap from the palmar surface. This operation occupies pages in books upon operative surgery, and is a sort of test of skill in the dissecting rooms. It is quite convenient to know that an incision at the distal curved wrinkle on the back of the joint will exactly open its cavity without uncovering the bone too much; and that it is the lateral ligaments which resist disarticulation. It is not often, however, that the regularly described operation will apply to a diseased finger. Fingers are often mashed or largely swelled; and the best rule I know is to get a good covering wherever there is a bit of sound and attached skin, and then to divide the bone with forceps, unless you are very near to a joint. The arteries play a little, but if the flap is stitched or otherwise fixed in place, and the finger compressed with a narrow bandage, they generally stop without tying.

CASE III. *Tumor in the Nose. Operation.* — This may be called a tumor of the nose, for it certainly is not anything else. It is, as far as I know, anomalous, and is a most extraordinary affair. It came like a polypus, and looked like one; but it certainly is no polypus. The woman is about forty years of age, and has been otherwise healthy, but within a few months she has lost flesh. Her attention was called to the pain in the nasal and ethmoid bones about nine years ago, when, after a good deal of suffering and some constitutional disturbance, a "gathering broke," and there was a discharge of fetid pus from the left nostril. This occurred at intervals afterwards; but about five years ago she expelled, by blowing from this nostril, a bit of white thick soft matter. This has happened several times since, and twice a mass of it as large as the last joint of the little finger. This sort of history is very common. There is a class of patients who are made very unhappy by what they blow from their noses, and there is sometimes disease and sometimes not. "White matter" often means only abundant opaque mucus. So that this account alone was quite unsatisfactory, except that inspection of the nose showed what appeared to be an ordinary polypus high in the left nostril. The history of this growth went to confirm its character. It "came down," that is, came forward and in sight, a few weeks ago. Since last April it has been gradually obstructing the air on this side, and at present the stoppage is complete; the patient volunteering the statement that it becomes larger in damp weather. Common polypi do this, and with the present evidence this was likely not to prove an exception. The operation, as you saw, was performed in the ordinary manner. I introduced a pair of oiled polypus forceps so as carefully to include the tumor, shut the handles tightly, and after one or two twists brought out the closed instrument, containing in its grasp what appeared to be — nothing. I men-

tioned, at the time, that this was a common experience; that a polypus of some size, when its contained serum has escaped, often leaves only a collapsed bit of mucous membrane, concealed between the blades of the instrument, to account for a considerable obstruction removed. The forceps here showed only a little pasty material at their extremity. They were again introduced, and with the same result; but at this time the patient blew from the nose a fragment of this paste. Repeated introduction of the forceps, alternating with the expulsive effort, at last cleared the nasal passage by the evacuation of two good teaspoonfuls of the same material. This was a dirty white substance, perfectly destitute of obvious organization, about the consistence of white lead, smooth, homogeneous, and with a faint smell of macerating bone. Under the microscope it showed only very minute granular material, a very few small cells here and there, and occasionally fragments of fine fibres; the whole field presenting the aspect of common tartar taken from teeth more nearly than anything I know, but without calcareous deposit, and exhibiting only fragments of the long and fine fibres found in tartar.

The question is then upon the nature of the affection. Is this polypus alone, mucous, fibrous, or malignant? or is this material superadded to polypus, or connected with it? It is obviously something foreign to the usual history of the affection. We have sometimes calcareous concretions in the nares, but apart from its resemblance to non-calcareous tartar, this material has no evident affinity of that sort. The early progressive character of its history now becomes of interest, and we may infer that what was once a slight is now an aggravated lesion; and we know that it was once attended with exacerbations accompanied with headache and terminating in a discharge of pus. This would suggest some chronic affection of the bone, perhaps tubercular. But I

am aware of no regular affection of the antrum or ethmoid resulting in this way, and it seems improbable that a soft secretion should accumulate in such quantity in the nares without becoming disintegrated and semi-fluid to a degree which would facilitate its escape. With these speculations, and preferring to show a curious case in its actual, though it may be temporary aspect, I leave it for the present.

MONDAY, December 16, 1850. *The Case of Hernia*[1] treated by an injection into the ring of thirty drops of the tincture of iodine, left the Hospital "well," in three weeks after the operation. Before the operation, the intestine came down during exertion, even with a truss; and if the truss was removed, it slipped out at once, without effort. When the patient left, he could, as you saw, cough in the erect posture without his truss, and not cause a descent of the hernia. During the first three days there was tenderness exactly at the ring; but no peritoneal or constitutional symptoms. He constantly wore a bandage or a truss, and is now "cured," if he will but remain so. Time only can show what effect the absorption of the lymph will have. On the other hand, his condition has been undoubtedly improved, with slight risk and pain, and less than three weeks' confinement.

The patient with anomalous affection of the nose[2] has been discharged, considering herself greatly relieved. When the coagula had been, in the course of a day or two, discharged from the nostril, the original "polypus" showed itself as a fold of thickened mucous membrane, dependent from the upper turbinated bone. This was easily removed, although it had not obstructed the nostril, which had been already cleared.

CASE I. *Nasal Obstruction. Operation.* — Another patient has left the Hospital relieved of a difficulty which seems to

[1] See Lecture, November 16, p. 207. [2] Ibid., December 2, p. 223.

have excited some interest. This young girl had been supposed to have a tumor in the front part of her left nostril; said she had some pain there, and that respiration was not free. I found something reaching from the vomer over towards the left lower turbinated bone, which it met. Both mucous coverings were swelled, and at their point of contact white, as if suppurating, and exquisitely tender if touched by a probe. In the other nostril, a little way back, there was a sudden hollow in the vomer, which could be felt by a probe better than seen; and this depression corresponded to the other prominence. So that all I was able to make of this "tumor" was a deviation of the vomer, which, projecting across against the turbinated bone, was ulcerated and tender. Nitrate of silver was applied several times, relieving the tenderness; but finding that it was not effectual, I removed the turbinated bone in part with polypus forceps, then with an oiled finger forced the vomer back to its place, and left a sponge in the nostril to keep it there. The face became swelled and painful, and the patient quite feverish up to the fourth day, when the sponge was removed. She then soon recovered, and left the house as she said "cured," the nostril being well opened.

Case II. *Club Foot. Operation.*—The tendo Achillis was divided by Dr. Hayward. There were one or two points of interest in this case. It was in a child of six, paralyzed in the lower limbs during four years, but recovering the use of them the last year. Paralysis is a common cause of slight club foot, but not of the hopeful forms of it. In other words, the paralysis itself makes the operation useless. It acts unequally on the flexors and extensors, and the gastrocnemius, aided by the natural position of the foot, gets the advantage, so that the foot cannot be flexed. If the paralysis continues, it is useless to divide the tendon; but here the

patient could walk. This limb measured one inch less, from the knee down, than the other. This difference puts some bad cases of club foot beyond the reach of art. It is an arrest of development, due in part to the traction of the tendons, but more to a continuance of the original action which produced the deformity. Of course, a muscle may be greatly reduced in size from disease, and even undergo the fatty or fibrous transformation, and still recover its texture and tone after the foot is brought straight. But in the hopeless cases, the long bones are actually shorter and smaller, and no orthopedic treatment will restore their dimensions. In this case the heel will readily come down.

Case III. *Epithelial Disease of Face. Operation.* — This was a large pimple upon the skin over the malar bone of an old lady. Such a pimple is very common on the face in old people, and it is important to know it by sight. It is the "cancer of the lip" occurring elsewhere. You saw here two pimples, side by side. One, the old lady said, she did not care for; it had been there always. It was flabby and pediculated. It was in fact a "pediculated tumor," so called, and harmless. But the other, though smaller, gave her great pain; it was only of a few years' standing, red, elevated, and hard. At its summit was a little scab. I removed the whole with the knife, and by a long ellipse to avoid a pucker at the extremities of the united incisions. Bisected, this tumor was dense and opaque white, continuous laterally with the skin, and below with the white fibre of the cellular tissue upon which it was seated. Under the microscope it was distinctly epithelial, like the lip described in a previous lecture, and just as capable of ulceration. An old man applied to me a short time ago, with a large everted, ragged, and ulcerated elevation on the cheek, under the eye, adherent to the bone. It was past much hope of benefit

from operation, but doubtless was once an epithelial pimple, which could have been easily and radically removed like this.

Case IV. *Inverted Toe Nails. Operation.* — Many of you know this affection. The great-toe nails are buried, as in this case, at their edges, deep in fungous granulations, so tender that they cannot be touched. This begins gradually, with a tight shoe, or an irritable skin, and a nail uncut at the corner. The flesh gets tender, the corner cannot be got at, and the affection progresses or remains stationary. It rarely improves even with palliative treatment. I once raised a nail slowly, with lint beneath it, so that in a week the corner was cut off, and the patient never again suffered. But you are generally obliged to remove the nail, or a part of it. The patient is etherized, and if the nail is thin you thrust one blade of a pair of forceps under it to the root, shut the forceps upon the nail, twist first to one side and then to the other, and extract it, as was done here. If it is thick, first split it to the root with scissors thrust under it, and peel off one or both halves from tip to root with forceps. These nails came out whole, but the nail should in general be examined after extraction to see if the corners of the soft root are square, as a bit is often left in at the edge which reproduces the deformity. A new nail generally appears, sometimes deformed. In this case, Dr. Hayward removed three nails.

Case V. *Fatty Tumor inside of Cheek. Operation.* — This middle-aged woman perceived this tumor four years ago. Its position, just inside of the labial commissure under the mucous membrane, is a common one for little sacs containing glairy fluid. This looked like one, and fluctuated, but proved to be a common adipose tumor as large as a chestnut.

I removed it by a simple incision. The ether was continued to this patient for some time after narcotism, and until she snored; her pulse being only reduced a little in frequency. This thorough dose lasted her through the operation. With a common dose, she would soon have partially waked, shut her mouth, groaned and twisted about; and after vain efforts to get along, we should probably have stopped the operation to give her more ether. As it was, she slept tranquilly until it was completed.

Case VI. *Disease of Antrum. Operation.* — This patient of Dr. Hayward, thirty-two years old, a year ago perceived a swelling just under the edge of the left orbit. It was opened and discharged pus. Soon afterward another opening thought to be a gumboil formed spontaneously over the second molar; but a copious and daily discharge of pus at this point discredited the idea. On applying to a surgeon, a probe was passed into one opening and out of the other, traversing the antrum. Since then, the antrum is said to have been punctured twice, and a seton to have been passed once. Lastly, fœtid pus has been and is now blown from the nostril.

Here is a well marked affection of the antrum; and attention may be directed on the one hand to the mucous membrane and bone of the cavity itself, and on the other to the fang of a tooth and abscess of the gum, as the usual causes of such purulent accumulations in this sinus. Here the first pus escaped near the orbit, where there is now a scar, and the discharge is fœtid, considerations which direct us to the antrum and to the bone. It is a case difficult of treatment. The patient was desirous of an opening into the cavity, which Dr. Hayward made by boring through the thin shell just above the second molar tooth. Some of you may remember a similar case in my wards last year. Great pain and tension on the left side was then relieved by tapping

the antrum in this same place. Pus escaped, and the patient, encouraged by the success, was very desirous to have the other side opened, there being an uneasy feeling there. I advised him against it, for want of indications; but subsequently, as the operation is in reality a small affair, yielded to his solicitation. There was no pus, and the jaw swelled largely. In the first instance, the opening evacuated pus and was a relief. In the second, it was an injury to a comparatively sound part, and was at once felt. As to the operation, if you do not perforate the socket of a tooth, find the base of the zygomatic arch above the molars, incise the mucous membrane freely, and expose the bone; otherwise the blood is apt to distend the tissues, and make the landmarks obscure. You then bore through the thin bone with any convenient instrument. I have used a three or four square pyramidal point.

Cases VII. and VIII. *Hydrocele.* — Two more cases, illustrating the varieties of this affection. One in a young man, and of three or four years' standing; the other in an old man, and of eight or ten years' duration. The former and smaller had a constricted middle, giving it an hour-glass shape. The latter was the longest and narrowest I have seen, extending from the ring to the bottom of the scrotum, nearly seven inches. and only two or three inches in diameter. These forms are accidental: both were translucent. The small one was injected with a dram of tincture of iodine and a dram of water, of which half was withdrawn. The other operation was only palliative. It is generally not worth while to expose a very old person to the risk of inflammation, though I have operated upon a man over eighty by incision, and successfully; yet it is generally better not to do so. As an example of the effect of the palliative operation I may mention the case of a man of nearly ninety, whom

I tapped six years ago, and only twice since. The fluid collected slowly, and the risk or pain of the puncture was small. You can diminish the pain by thrusting in the instrument suddenly, not slowly. Of course you make the sac tense and thin, avoid the testicle, and guard the canula with your forefinger at a short distance from the point to prevent it from plunging too deeply. A patient who had once been operated upon slowly remarked to me, after this sudden puncture, that he must have been tapped before with a screw auger. Another point in the radical operation is to carry the canula well home into the sac, and to hold it there by pinching the skin, otherwise you may inject the cellular tissue instead of the cavity of the tunica vaginalis.

The other two patients have gone out well, both of them in two and a half weeks from the operation. In one, there was at the end of the first week a distinct crepitus on pressure of the sac, no doubt from the rupture of little cells of lymph containing water. This is interesting, in connection with a rare and exceptional subcrepitus due to the same cause in the pleura, and which is to be distinguished from the moist râles of the pulmonary cells and tubes.

Case IX. *Stricture of the Œsophagus. Dilatation.* — The pathology of this affection we reserve for another day. The difficulty of passing the probang, to those unaccustomed to its use, consists mainly in its being brought up hard against the vertebræ behind the pharynx, if the instrument is stiff. To avoid this, the head is thrown well back, and, if need be, a finger of the left hand is carried past the epiglottis to bend and guide the instrument in the œsophagus. By doing this, you will avoid the danger of pumping a pint of broth into the lungs with a stomach pump, as was once done.

JANUARY 20, 1851. CASE I. *Fatty Tumor beneath Fascia.* — The first patient upon whom you saw an operation performed on Saturday was a boy with a large tumor extending round the arm in the deltoid region. It was of seven years' gradual growth, and had now become bulky and inconvenient. It offered some quite unusual features. Large fatty tumors are common enough in this region. I removed one weighing four pounds and three quarters from the arm of an old lady who was soon quite well. "Shoulder-strap tumors," which lie over the outer triangle of the neck, are popularly supposed to be produced by the rubbing of the dress upon the shoulder, and are of this nature. The back is a common place for them, and the female breast also. In short, they grow almost everywhere, and directly under the skin. I had one patient in whom the existence of six or eight at various points showed the disease to be constitutional. From all localities the removal of the fatty tumor is usually a small matter, excepting perhaps in the back of the neck. The mass lies in the cellular tissue; and where this is lax, by distending it, the tumor grows with few lobes; but where the surrounding fibres are dense, they cut it up into numerous lobes. Now the fatty tumor has a habit of getting through an aperture in the cellular tissue or anything else, and of growing upon the other side into a lobe too large to be drawn back through the same hole, so that you must cut or tear the band of fibres at the neck of each lobe, and then the whole mass is very readily and neatly turned out of its bed. But suppose the cellular tissue to be so dense and close, as about the *ligamentum nuchæ*, that you cannot tear it, while for the same reason the tumor has been cut up into a great number of little lobes, each held by its neck in a little cavity; to dissect out all these would be endless, and you are obliged, as has twice occurred to me, to take out the whole mass from the back of the neck, invested with the cellular tissue. It is quite like

removing a breast, but less easy because there is more resistance, and this even where the tumor has previously seemed to be very loose and movable. Elsewhere, cut well down upon the tumor; keep it dissected clean; cut on the tumor and not into its neighborhood, and you will have no difficulty. In the present case you saw six inches of the brachial artery and vein dissected quite clean and exposed. You often hear of large vessels being exposed in the removal of a tumor. Do not get the idea that they are purposely denuded, or that such a dissection is made with the intention of enucleating them. It is not so, and you will readily see how it happens. A tumor grows beneath the fascia, and presses upon the neighboring cellular tissue, which is absorbed before it until in fact it lies directly against a large artery and vein. Now you will find that in dissecting you can often draw the tumor away from these vessels, so that, always keeping the edge of your knife against the tumor, it may perhaps never be nearer to the vessels than an inch; and yet when the mass is out, and you examine the bed in which it laid, you will find the large artery and vein just as close to the surface as they were to the tumor; perhaps, as in this case, bare, and directly upon the surface.

The present tumor extended quite round the arm, beneath the long head of the triceps, and on the inside had pushed under the brachial artery and vein. It was also traversed by an artery as large as the facial, and indented by the internal cutaneous nerve. It began small, near the insertion of the deltoid. I stated to you that it had all the features of a fatty tumor, large and fluctuating, lobulated outside, but less so on the inner aspect. The only doubt lay in the fact that fatty tumors do not belong beneath the deep fascia where this evidently was. They almost always grow directly under the skin. I never saw one so deep before. Yet they are recorded as being found beneath the trapezius, and even

the mamma. So that in making the diagnosis, and allowing for its anomalous position, which rendered it a little obscure, I mentioned fatty tissue as the probable material. I made a long incision inside the biceps, and separated the tumor from the artery, vein, and internal cutaneous nerve. A parallel incision six inches long was then made on the outer side of the arm near the triceps, and the chief obstacle to the removal of the tumor found to be a close attachment by its membraneous septa to the periosteum itself. These being divided, the aperture beneath the triceps was dilated, and the tumor was then drawn out from this opening under the muscle and through the external incision. It weighed one pound and four ounces.

Case II. *Disease of Ankle Joint. Amputation.* — This patient, from Dr. Hayward's ward, during a period of seven years had more or less pain and lameness in the joint. For a year he was unable to use the limb, and during this time quite a number of fistulous openings communicating with the joint have appeared; I believe a dozen, — an unusual number. The joint is, you see, swelled and blue, and the leg atrophied almost to the bones. About such a leg there can be no doubt. Whatever the disease may be called, — scrofulous disease, pulpy, cartilaginous, or synovial degeneration, or disintegrating lymph, — there is practically very little hope in a case of this sort. Under favorable circumstances the diseased cartilage and bone might become destroyed down to a point which leaves sound bone, which in its turn might become anchylosed. This is the only recovery from such a mass of disease. But in the mean time the pain and fever are reducing the patient; the liquor sanguinis is drained by the discharge of pus, and the strength gives out. There is a peculiar disease, in which a small ulceration in an otherwise apparently sound cartilage is

productive of great pain, and often compels amputation of a limb. But the present affection, which is by far the most common one, exhibits no clean ulceration. You see in this joint a part of the cartilage roughened; elsewhere more deeply pitted, and largely detached; the bone exposed; masses of granulation; the whole articular surface greatly diseased, and very little or no sound cartilage. The affection has also extended to the tarsal articulations. The progress of this sort of disease is usually not steady, but by repeated exacerbations, with intervals of comparative freedom from pain; and the patient may be reduced so gradually that it is sometimes difficult for the surgeon who sees the case day after day to decide the precise point at which treatment should be abandoned, and amputation resorted to. Seeing the same case for the first time, you would have less difficulty in making up your mind.

A patient greatly reduced by a diseased joint often recovers rapidly after its removal. Yet even then life sometimes flickers feebly for a time, and the patient sinks under the shock of amputation. Perhaps the chief point to be settled in respect of strength is the soundness of the great viscera; for with disease there, and in spite of a few recorded cases to the contrary, the case is almost hopeless.

This limb, long past the stage of doubt, was removed by Dr. Hayward by the circular operation.

You will hear much of the relative advantages of the circular and flap operations. But as there is so much diversity of opinion upon this point, you may be sure there is no settled best way; and as for the rapidity of amputation, if ever it was a prime object, with ether it is now no longer so. The one thing needful is skin enough to cover the bone. If one side of a limb is ulcerated or injured, you get it from the other side, and this is a flap; or you may make two flaps, — on the sides, or top and bottom, or as you please, so long as

you cover the bone and do not waste material; for the best artificial limbs are now made with deep sockets, and the longer a stump is, the better. This flap was circular, and the stump will be doubtless an excellent one, reaching two thirds of the way to the ankle. Accidents may happen to all stumps. Flaps retract, bones protrude, and sequestra come out. But if the bone is once properly covered, nature has much more to do than the surgeon in keeping it so. I once had an opportunity to try the circular and the flap operation upon the same subject, in a case of mortification of both legs, after dysentery on shipboard. The patient was at death's door, but rallied at once upon the removal of the legs at about their middle. This was soon after the use of ether, and the patient, of course, slept throughout these amputations. Both wounds healed by first intention. The circular flap puckered in healing, as it generally does. Upon the other leg, the long flap from behind gave apparently the best result, — a handsome rounded stump, with a linear cicatrix. Yet it is probable that a few years would make them much alike. The muscle and fat of a large flap is then atrophied, and the roundness lost. This I may state as also the view of Dr. Townsend, whose opportunities for examination were frequent during the last war.

Case III. *Necrosis of the Humerus. Operation.* — The disease in this case was of fifteen years' duration. There were a number of fistulous openings about the deltoid, leading to dead bone, and a large one also between the clavicle and scapula above, traversed by the omo-hyoid muscle, which bisected it. Water injected here was followed by an increase of pus at the lower opening in the course of the day. I am unable to say why the pus, which was burrowing about in the axilla, should have made this large ulceration so high up, or whether it depended on a separate cause. As you

saw, I made a free incision down to the bone on the outside, and through the deltoid; waited for the capillary bleeding to cease, and tied a small vessel or two; denuded the bone, removed with a trephine upon a bit-stock a middle-sized disk of new bone a quarter of an inch thick, and extracted through the opening a sequestrum in shape like a large almond. The object of such an operation is to get at and remove a sequestrum which is confined by bone, generally of new formation and thick. You feel with the probe a bone unequivocally loose and apparently quite accessible; you cut through the soft parts in pursuit of it, and are suddenly, perhaps to your surprise, arrested by a bony wall with an aperture only as large as a crow's quill, into which the probe passes perhaps half an inch. The old way was to attack this with a chisel and mallet. But put a femur into a common vise, and try with a chisel and mallet to expose the interior of its shaft, and you will find how slowly the work goes on. Now there is a French instrument (*scie à molette*) which I have used for a number of years, consisting of a small circular saw, attached to an iron rod, which receives its revolutions from a bit-stock in the hands of an assistant. The rod is about two feet long, and is broken for convenience by a universal joint. A hole is trepanned into the bone, and if the sequestrum is refractory, another hole is also trepanned a few inches distant, and the circumferences of each united by parallel lines, so as to make an oval hole. This last is done by the circular saw, and the little time it occupies and the facility of its work are quite striking. I should say it required about one minute for ten consumed by the old process. A beautifully symmetrical hole may be made in five minutes, which would require half an hour's work of the chisel. This is really an advantage of importance. Here are sequestra which I have removed in this way: a long one from the femur; this one, not unlike a but-

ternut in size and roughness, from the left ramus of the jaw, and moreover infiltrated with salts from the saliva. Here is a very remarkable sequestrum from a boy, a patient of Dr. Osgood of Saxonville, which is actually two thirds of the humerus. Its upper extremity projected through the skin just under the axilla, while the whole articulating surface at the elbow was salient and exposed obliquely outwards. The whole looked somewhat like a large spike, of which the condyles represented the head, driven in obliquely at the elbow, and its point appearing under the axilla. And here are the marks of the boy's penknife upon the exposed joint, where he amused the tedium of convalescence by whittling it *in situ*. You would have thought, as I did, that it could be pulled out from below with ease. But it was so bound and clamped by new bone, which pinched it, that I was obliged to remove the last to some extent before it yielded. And it is strange that the boy has a serviceable joint at this day, traversing an angle of about 45°.

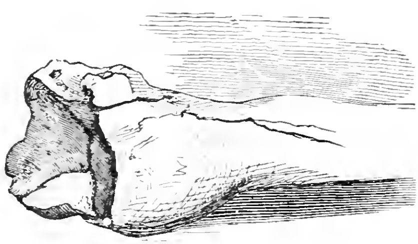
Here is another sequestrum with a wisdom tooth in it, larger than you would suppose could be contained in the ramus of the jaw. Necrosis is sometimes rapid. I removed this specimen from a patient of Dr. Dale. It was eliminated in a few weeks from the first metatarsal bone of a boy, and is, as you see, quite a piece of its shaft.

This operation has its reverses. Here is the femur of a patient, obtained two years ago, in whose case the fistulous opening was directly in the track of the artery. I therefore attacked the bone upon the outside through the vastus externus, and made this opening into it. The patient, a healthy laborer, died the next day of a remarkable affection,—a formation of pus beneath the layers of deep fascia and among the muscles of the whole thigh, showing universal inflammation there. Besides which, before death, the limb was inflated by gas as in a decomposing subject.

There are a few points of diagnostic interest which should be mentioned. The size of the sequestrum may sometimes be judged of by the enlargement of the bone, and by exploring it through different apertures. Yet if it is deep-seated and these signs fail, the size of the dead bone is often deceptive, and a very small sequestrum may give the idea of being large. Its mobility is sometimes unequivocal; and upon this point there are two signs I have noticed, not mentioned in the books, I believe, to which I attach some value. One of these is the possibility of causing pus to escape from one fistulous opening by pressing upon the sequestrum with a probe through another and separate aperture. How is this likely to happen unless the sequestrum moves? Again, pain — not a common local and acute tenderness, but a deep and distant pain — sometimes attends the forcible movement of a large sequestrum by a probe in a fistulous opening. The sequestrum is then tilted against soft granulations at a remote part of the cavity. In such cases, the sooner the sequestrum is removed, the better. The pathology of necrosis belongs to another part of our surgical course.

STELLATE CRACK OF THE RADIUS AT THE WRIST.[1]

Dr. H. J. Bigelow showed the carpal extremity of a radius, which presented on its articulating surface a star-shaped crack, without displacement. Slight corresponding cracks were seen in the shaft for more than an inch. The patient had entered the Hospital, under Dr. Bigelow's care, for other injuries, which ultimately proved fatal. At first, complaint was made only of lameness at the wrist, like that from the effect of sprain; but at the end of several days the joint exhibited swelling and tenderness, which, from its persistence, led Dr. Bigelow to diagnosticate a stellate crack in the articulating extremity of the radius as the probable result of a fall, he having met with a case two years before in which a patient with similar symptoms, dying of other injuries, had exhibited a crack in the same place, but less extended than this. Dr. Bigelow remarked that the bones of the wrist doubtless acted as a wedge to spread the corresponding hollow of the radial extremity, — and that this specimen would explain the persistence of some cases of sprained wrist.



[1] From the Records of the Boston Society for Medical Improvement; published in the Boston Medical and Surgical Journal, March 4, 1858.

LEUCOCYTHÆMIA.[1]

Leucocythæmia is a term applied by Bennett to a condition of the blood described by himself,[2] and a few weeks afterward by Virchow, characterized by an excess, sometimes considerable, of the white corpuscles. This condition is usually accompanied by disease of the absorbent glands, or of some of the viscera supposed to be concerned in the production of the elementary constituents of the blood. But it may yet be a question whether this excess of the white corpuscles is a cause or an effect of the visceral disease, or only a collateral circumstance. Virchow views it as a secondary lesion, dependent upon affections of the absorbent glands or of the spleen; and late English writers adopt his division into the *absorbent* and the *splenic* variety of leucocythæmia, both of which are embraced in the present single case. Dr. Wilks[3] makes this division more definitely as follows, and attempts to found upon the second variety a new disease: 1. *Leucocythæmia splenica*, characterized by an excess of white corpuscles and an enlarged spleen. 2. *Anæmia lymphatica*, a name suggested by the extreme pallor, debility, and prostration of patients affected with enlarged absorbent glands: the writer apparently inferring from these symptoms a fact which might be difficult to establish in the field of a microscope, — that the white corpuscles are not more numerous, but only the red ones less so.

[1] Boston Medical and Surgical Journal, February 2, 1860.

[2] Edinburgh Journal, October, 1845.

[3] Guy's Hospital Reports, vol. ii., 1859.

To the surgeon this disease is interesting, as the frequent though not constant accompaniment of an enlargement of the absorbent glands, which, as I have seen it, occurs oftenest in the neck. About ten years ago, a gentleman of middle age and remarkably robust constitution died under my care, with great enlargement of the cervical, axillary, inguinal, and lumbar glands, gradually increasing during about a year; the autopsy showing also a slight enlargement of the spleen. This was doubtless a case of the general character of that now reported, but which passed for one of encephaloid disease of the absorbent glands.

Near the same time, a man in fair health, of about sixty-five years of age, presented himself with a single ovoid gland at the front of the neck sufficiently loose to justify the operation he desired. Excision was effected without difficulty, but the patient fell off and died a week after. A few slightly enlarged cervical glands were discovered behind the single prominent one, and the autopsy revealed disease of the left lumbar glands. No visceral enlargement was noted in a brief examination for cancer; but the large gland, of which I have preserved an admirable colored drawing, measured four by three inches, and presented on section the appearance hereafter described. Microscopically, it proved to consist almost wholly of uniform granulated corpuscles, resembling those of a healthy gland, and which were recorded as an exceptional appearance of encephaloid structure. A child two and a half years of age was brought to me with a chain of very large glands around the neck and in the axilla, also one below the clavicle, all wholly destitute of inflammation, and which were considered to be encephaloid; the child died the next year, the masses having continued to enlarge without other change.

These cases, like others which might be cited, are doubtless examples of a lesion which is at present considered to

have nothing in common with encephaloid disease. The peculiar condition of the blood now described may indeed accompany a cancerous or a tubercular diathesis, with the development of either disease even in the glands, but it is said to have no relation to them. The voluminous, elastic, and well rounded outline of the glands, moulded one upon another, without adhesion, cannot easily be mistaken for the hard beaded kernels of the scirrhous affection, nor for glands hardened by chronic inflammation, whose brown interior contains spots of whitish lymph or of cretaceous matter. They have still less resemblance to this scrofulous inflammation when tending to suppuration. But, without inflammatory adhesion or change, they show on section a uniform reddish white semi-translucent and tender tissue, of which the microscopic elements are uniform nuclei, very similar to those of the healthy absorbent gland, with the addition of abundant white corpuscles or cells and granules.

At the same time it should be borne in mind that certain tissues are still regarded as cancerous which are mainly composed of minute and uniform granulated cells, and which strongly simulate in their gross and microscopic appearances some of the products of the disease now under consideration.

In the following case the gradual diminution of the cervical glands during the persistent use of the hydriodate adds to its interest, whether the decrease resulted from the remedy or not.

The patient was a tall, well formed man, aged thirty-nine. The obvious and striking feature of his case was an enlarged neck, of lobulated outline and elastic to the touch; the interval between the lower jaw and collar bone of either side being distended almost to a level with the cheek, while, behind, the tumor overlaid a part of the trapezius muscle. This swelling plainly consisted of enlarged glands, varying in size from that of a flattened goose's egg downward, and

impacted together, yet elastic and without induration, destitute of heat or the signs of acute inflammation.

Upon inquiry, similar masses were found to exist in the armpits and in the groins. In the left armpit the largest gland was about three inches in diameter, and one lay behind on the scapula, the whole being pressed out when the arm fell. The right armpit contained a somewhat smaller mass, while the larger glands of the groin may have measured an inch and a half across. None of these tumors were attended with pain or tenderness.

The patient was at this time (June, 1858) easily fatigued, but otherwise his health was good, and he was in active business.

Without especial hereditary tendency, and with previous good health, he had a bad cough through the spring of 1858, which excited the serious anxiety of his friends. In May he visited Sharon Springs, a sulphur water, where he was subjected to active daily catharsis during six weeks, his strength not improving, though he felt pretty well. Immediately on his return home in June there was a simultaneous and painless enlargement of all the glands above described. He thought there had been, for a month or two before, a little fulness of the left side of the neck, yet of this he was not certain; but the sudden growth of all these masses was now unequivocal and striking.

He was directed to take iodide of potassium, and in a few weeks reached the dose of fifteen grains three times daily, applying besides the iodide of lead ointment abundantly at night to all the glands. This treatment was continued through the summer and autumn, alternating occasionally with the experimental application of the tincture of iodine to a part of these glands. During this time the cervical glands slowly and steadily decreased in size, becoming flabby, — the circumference of the neck decreasing from

fifteen and a half to fourteen inches, — until the end of August, from which time till the death of the patient in November they rapidly subsided. At the time of death, the glands on the neck were quite flat, the largest measuring less than an inch in length, and the neck being of normal size.

Equally remarkable was the subsidence of the swelling in the left axilla, where a gland previously enlarged to the size of a hen's egg had now diminished to a third of that volume, others being reduced to normal dimensions. But in the groins, the glands were still swollen as before, while the autopsy revealed large glandular tumors existing in the abdomen.

During the summer the patient became pale, and occasionally had epistaxis; but until October no other symptoms of importance occurred, except a sudden and intense hemicrania in the early part of this month, which yielded in three or four days, after the administration of Fowler's solution.

In the latter part of October, a remarkable vesicular eruption appeared on both the lower limbs, occupying chiefly the thighs, the vesicles presenting an inflamed base, and attended with intense smarting and burning. The pulse was accelerated to 130 and upward, while the vesicles increased to large phlyctænæ, until by their coalescence the cuticle was detached, so that the front of the thighs and the abdomen offered continuous raw surfaces of inflamed granulations over most of their extent, apparently occupying the substance of the true skin, and adding greatly to the suffering of the patient. This circumstance prevented examination of the chest further than to ascertain the probable existence of pleuritic effusion, to which attention had been called by the dyspnœa which now supervened.

The patient was confined to the house only a fortnight before death, which occurred on November 11, 1858, its

immediate cause being fever of an irritative type, apparently induced by the spread of this remarkable herpetic eruption, although neither this nor the final pleurisy had any obvious connection with the disease of the glands and of the viscera which the autopsy revealed.

Autopsy, by Dr. Ellis.— Head not examined.

The left pleural cavity contained, by estimate, nearly one pint of serum. The pleura of the lower lobe of the lung was covered with a thin, recent, reticulated, fibrinous layer. In the opposite pleural cavity there was also a small amount of serum.

The great part of the lower lobe of the left lung was compressed, but a portion, upwards of two inches in diameter, had a somewhat yellowish appearance, as in the third stage of pneumonia, but was limited in a remarkable manner by a sharply defined line. A part of the lower lobe of the right was also firm, and of a dull red color, as from compression. The remainder of the lungs was healthy.

The heart was generally hypertrophied, but without valvular disease or other lesion. The right side was filled by a large yellowish white coagulum, which extended into the vessels in different directions. In the left ventricle was a small amount of the same. Many of the veins examined in the different parts of the trunk were filled with similar coagula. These all differed from the coagula usually seen, where a separation of the fibrine has taken place. They were less gelatinous, more opaque, and altogether peculiar, their exact appearance not being expressible in words. From the jugular or subclavian vein, however, there escaped a substance resembling thick pus.

The liver was very large, weighing, by estimate, about seven pounds. On some parts of the surface were depressions or cicatrices, and portions had a somewhat lobulated appearance, but the latter was not well marked. The sub-

stance generally was of a brownish red color, very much like that of the healthy organ, but the cut surface did not look perfectly healthy, although the change was indescribable. In the right lobe, scattered over a portion three or four inches in diameter beneath the upper surface, was a peculiar whitish deposit, looking somewhat like firm encephaloid, distributed for the most part in the form of points and streaks, as an infiltration among the lobules, the largest portion not being more than two or three lines in diameter, but still continuous with the rest.

The spleen was ten inches long, six broad, and four thick. Its consistence was sufficiently normal.

In each kidney were a number of white bodies, about a line in diameter, and of the same color and general appearance as the deposit in the liver.

The left supra-renal capsule was quite large, and contained much of the same whitish substance described in connection with the liver. The right capsule was perhaps slightly affected in a similar way.

The intestines were not opened, but externally appeared healthy.

The cervical glands were somewhat enlarged, but not sufficiently to produce any deformity of the neck.

Those of the abdomen generally, the lumbar, the iliac, the mesenteric, etc., were very much enlarged, many of them being upwards of two inches in diameter. They were for the most part rather soft, friable, and of a mingled light and dark red color. Some contained small ecchymoses. In one, in the left lumbar region, suppuration had taken place.

The other organs appeared sufficiently healthy.

Microscopic Examination. — The purulent looking substance from the subclavian, and the yellowish white coagula, were found to be composed almost entirely of small granular corpuscles from 0.004 mm. to 0.005 mm. in diameter, corre-

sponding with the *globulins* as described by Robin in the Memoirs of the Biological Society of Paris. The globules in the liquid blood from the subclavian were mostly red.

A few larger cells were seen, resembling the ordinary white corpuscles of the blood. Acetic acid caused perhaps some contraction of the smaller corpuscles, and showed them to be identical with the nuclei of the larger.

The enlarged glands, the spleen, the white substance in the liver, and that in the left suprarenal capsule, contained an abundance of small corpuscles similar to those found in the blood. In the spleen they were gathered together in groups, while the red disks floated singly through the field.

This case is one of great interest, being as it were almost an epitome of the facts which have been slowly gathered from isolated sources since the attention of the profession was first called to the disease by Virchow and Bennett.

We have here combined the two great varieties, splenic and lymphatic; but not that precise condition of the blood which we should expect were the views of Virchow correct. Two kinds of white corpuscles have been described; one large, like the ordinary white corpuscles of the blood; the other small, to which Robin has given the name of *globulins*. An excess of the former, Virchow declares, belongs to the splenic variety; of the latter, to the lymphatic. In one case the enlargement of the spleen and glands was equally well marked, yet the *globulins* were almost the only white corpuscles seen. Robin reports a case in which the spleen only was affected, and yet the same small corpuscles predominated very much over the others. He also speaks of the resemblance between the small globules and the nuclei of the large, after the addition of acetic acid.

New formations like those found in the liver and suprarenal capsule, although exceedingly rare, have been noticed.

Virchow[1] reports a case in which white deposits were found in the pleura, stomach, intestines, and liver. These presented the same appearances as the enlarged glands, and, examined microscopically, contained similar nuclei.

Virchow[2] also mentions two cases of the kind, in one of which the liver contained minute whitish deposits composed of nuclei like those of the lymphatic glands. In the other, the liver and kidneys were the seat of growths in which were corpuscles resembling those found in the blood of the heart.

This new formation he regards as similar to that which occurs in the lymphatic glands, not owing to mere infiltration with blood, but to a substitution of lymphatic elements.

But by far the most important feature in the case is the subsidence of the lymphatic glands. So far as has been ascertained, nothing of the kind has been anywhere recorded.

The connection between the condition of the blood and that of the internal organs is established. The question of their relation to each other will naturally arise. Virchow considers that the change in the blood is consecutive, but it must not be supposed that it necessarily follows the enlargement of the spleen or other organs, for such is not the case. Neither does an increase in the number of the white corpuscles always indicate the existence of leucocythæmia. There may be an excess of them after great losses of blood, in chronic exhausting diseases, or in those which are very acute, especially in pneumonia.[3]

[1] Archiv für Pathologische Anatomie, vol. xii. p. 38.

[2] Gesammelte Abhandlungen, p. 207.

[3] For an article on "Leucocythæmia," by Calvin Ellis, M. D., published in connection with the preceding paper, see the Boston Medical and Surgical Journal, February 9, 1860.

SURGICAL CASES AND COMMENTS.[1]

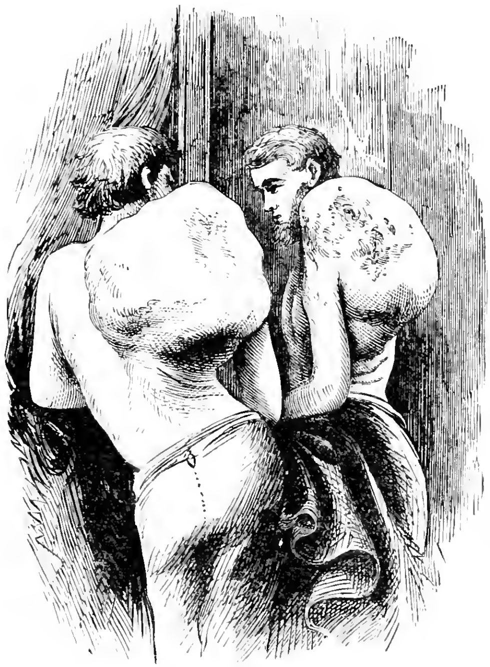
Case I. — *Enchondromatous Tumor of the Scapula.*

The following case is interesting chiefly for the large size of the tumor. The patient is a farmer, residing in Salem, Conn., and twenty-six years of age. His appearance is healthy, and his strength is such that he shoulders his immense burden without difficulty, and walks about with alacrity. He states that six years ago a tumor appeared upon the back of the right scapula, and continued to grow slowly for about four years, when it had attained the size of an orange. During the last two years the growth has been much more rapid. It now extends from a line just outside the vertebral column and parallel to it, over the right shoulder, apparently involving about two thirds of the clavicle, and the upper six inches of the humerus. It is of almost bony hardness, of very irregular outline, and firmly attached at its base. The irregularities are discovered both in its general outline, which is elevated, and at certain parts which are characterized by uniform conical elevations, half an inch or more apart, and rising an eighth of an inch or more from the surface, these last being more numerous upon its outer aspect, and hard or only slightly elastic. Upon the outer and upper surfaces of the tumor is a growth of hair, some inches in diameter, upon a discolored skin, which without doubt belonged originally in the axilla, and from which it has been displaced by the growth of the tumor. The clavicle

[1] From the Records of the Boston Society for Medical Improvement; published in the Boston Medical and Surgical Journal, March 31, 1864.

has become thickened, and is lost beneath the mass. The humerus presents two distinct knots, one below the tumor, the other upon its inner aspect. The skin is everywhere movable, excepting a small inflamed spot upon the outer side, where it shows some tendency to ulceration.

The following measurements were taken at the Massachusetts General Hospital, December 28, 1863. Circumference of base forty-five inches; antero-posterior circumference, including the axilla, thirty-nine inches; antero-posterior, transverse and vertical diameters, each fourteen inches.



The growth of this tumor, the manner in which it has invaded the bony structures, its characteristic outline, its firmness and elasticity, and the continued good health of the patient, leave little doubt of its enchondromatous character.

A graphic representation of the tumor is seen in the accompanying wood-cut, from a photograph taken, as the man stood before a mirror, by Black, of this city. This skilful artist has furnished to the College Museum a number of large and admirable representations of the patient, who was exhibited to the medical class in attendance upon the lectures,

as now to this Society; the patient himself appreciating fully the interest that has been felt in his case, and cheerfully submitting to whatever it was desirable to do for its full examination and for the perpetuation of its remarkable features.

March 14, 1864, Dr. J. B. S. Jackson recalled attention to the above case, and gave the following final history of it.

During the past week Dr. Bigelow received notice of the death of this patient, and of the willingness of his mother that the body should be disinterred for examination; but as he was obliged to leave the city for a few days, I offered to attend to the business for him. An arrangement was made with Dr. Charles M. Carleton, of Norwich, Conn., who had previously shown a strong interest in the case, and he most liberally devoted an entire day to the accomplishment of our object, the place of burial being at a considerable distance from Norwich. The body was carried, in its coffin, to a shed adjoining the cemetery; but it was found impossible to make such an investigation of the tumor there as the importance of the case demanded, and the entire mass was accordingly removed and brought to Boston for a full examination.

The weight of the tumor was thirty-one pounds. In regard to structure, it consisted, to a great extent, of as pure an enchondroma as would perhaps ever be seen, and the microscopic accorded with the gross appearances. The lobes were not so marked as in the two cases figured by Cruveilhier,[1] but the lobules were well defined, and the interstices were traversed, as usual, by an abundant fibrous tissue. Where the structure was firm, or rather dense, the lobules were closely compressed; but in other parts, and especially at the lower part of the tumor, they were considerably softer, and there they hung more loosely together. To some extent there were no formed lobules, but the mass had an amor-

[1] Anatomie Pathologique, liv. xxxiv.

phous though somewhat granular appearance; and here it was still softer, though it had none of the gelatiniform consistence that enchondroma sometimes has. To a small extent the firmer portion of the tumor had a rich reddish tinge; but there was nowhere any extravasation of blood. At some depth from the surface, and where the structure was quite firm, there existed an irregular cavity that would have held two or three ounces; it contained a brownish synovial-like fluid, and the defined parietes were formed by the enchondromatous structure itself. A smaller and similar cavity existed near the above; and in several of the lobules there was a central softening, brownish discoloration, and serous infiltration, as if in preparation for a cavity. The amount of calcareous matter was quite large; and it was generally scattered irregularly throughout the mass as a creamy white amorphous deposit. In very many of the nodules, however, it appeared on section as a narrow, defined line, and in the form of a more or less complete ring; and on further examination this ring appeared, in some of them, to be a section of a more or less complete little sphere. After removing typical specimens from different parts of the tumor, which will presently be shown to the Society, the remainder of the mass was put into water, and will be left to macerate, when a better idea will be had of the more solid part of the tumor; the external surface of the scapula being apparently exposed in the course of the dissection to the extent of half an inch or more.

The clavicle was perfectly healthy, though surrounded by the morbid growth except at its outer extremity, where there arose from its upper surface a bony tumor equal to one and a half inches in diameter, or more. This last was of a somewhat reddish color and cancellated structure, and was in fact an exostosis, as distinguished from the calcareous deposit above referred to; it arose from the outer parietes

of the bone, which last, though intimately connected with it, was continuous and healthy in appearance, as appeared on section. In this cancellated growth was one small enchondromatous deposit, and its upper extremity was directly continuous with a large mass of the same.

The shoulder joint was entirely disorganized. The head of the humerus was in part covered by cartilage; but one half of it or more was denuded, and to a considerable extent it was pretty deeply carious. The deltoid was quite well marked, and there were the remains of some other neighboring muscles; but the head of the bone lay loosely in a broad shallow cavity, lined by a soft red cellular tissue, in which no traces of the original joint were to be seen. The humerus having been removed, the two marked "knots" described by Dr. Bigelow were shown, and are distinctly represented in the photographs that were exhibited by him. One of them was about as large as the top of the little finger, acuminated in form, and on section appeared to be simply an outgrowth of perfectly healthy cancellated structure, the thin shell of bone that surrounds it, and the parts external to it, being also perfectly healthy. The other was considerably larger, situated rather lower down, and about the middle of the bone, but in other respects similar to the one described, except that instead of standing directly out from the bone it was bent down upon it; and on section the cancelli seemed to be filled with an opaque yellowish white, cerate-looking substance; it contained, however, nothing like an enchondromatous structure. The rest of this bone was healthy, the reddish color of the cancellated portion contrasting strongly with the interior of the "knot" last described. The existence of a pure exostosis, apart and by itself, in a case of enchondroma, is certainly an interesting pathological fact in relation to the nature of this last disease.

The right subclavian artery was considerably larger than the left; and, with the nerves, ran along the surface of the tumor, but without being embedded in it.

The separation of the mass was very readily effected, and the parietes of the chest were left in a perfectly healthy condition; a very important fact in reference to the result of the operation, if a removal of the tumor had been attempted during life.

The internal organs of the thorax and abdomen were also healthy externally, with the exception of a slight enlargement of the vertebral extremity of one of the middle ribs upon the right side, which ought to have been examined, but was not.

The following history of the patient's case was obtained from his mother, who, though advanced in years, is a woman of intelligence. It will be observed that there are discrepancies when compared with his own account, but these are probably no greater than we should often find in our chronic cases if different authorities were questioned. The tumor had been forming ten or twelve years; but it grew slowly until three years ago, when it was not larger than the head of a child at birth. Since then its growth has been very rapid, and during the last year it about doubled its size. There had been pain in the "cords of the neck" and down the arm occasionally for years, and sometimes it extended below the elbow. But the patient had no pain in the tumor; it troubled him only by its weight. His general health had been as good for the last ten years as for the ten preceding. Last month he was absent ten days on a visit to the medical schools of New York and Philadelphia. Whilst in the latter city "the veins burst" where the skin was sound, but thin and distended over the tumor; the bleeding was so free as to make him feel weak, but it was arrested. He began to fail from that time, returned home, and died in

eighteen days. The superficial sores enlarged in size, became deeper and sloughed; so that after death a cavity was found not far from seven or eight inches in diameter and one or two inches in depth, with much of the calcareous matter exposed upon the inner surface. The pain in the arm increased, but still there was none in the tumor. He was also unable to move his fingers or the forearm, and there was much numbness, though of this last there had been some before. Meanwhile he was confined to his bed, with loss of flesh, strength, and appetite.

A very interesting fact that was ascertained by a visit to the mother of the patient was the existence in her own case of a well marked enchondromatous tumor. It is situated just above the right knee joint, upon the outer aspect and towards the front. It is about half as large again as the fist, of a rounded form, quite knobbed, dense, with a slight degree of elasticity, immovable upon the bone, and occasionally quite painful. She is now sixty-six years of age and of good general health; and, the tumor having existed from childhood, she is sure, she says, that it has been as large as it is now for forty years.

Case II. — *Fibro-cellular Tumor in Scrotum.*

This case occurred in a patient forty-two years of age, and the disease was of one year's duration. The general aspect of the tumor was that of a very large hydrocele, but further examination showed the testicles to occupy nearly a normal position high up on each side near the pubes. There was no probability that the tumor was of hernial origin, as the inguinal rings were normal in size and clearly defined. The tumor consisted chiefly of slippery lobes that eluded the grasp, and was supposed before the operation to be either fatty or fibro-cellular. It may be remarked that behind and near the anus the insertion of the scrotum had

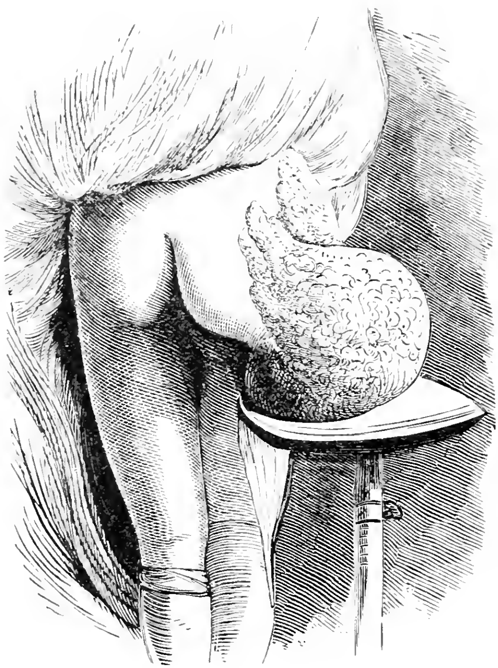
a brawny feeling, and the termination of the tumor was remarked to be there undefined. Upon cutting down, the first lobe that was exposed declared the fibro-cellular character of the tissue; and after a dissection, which was rendered tedious by adhesions, the tumor resolved itself into two principal masses. Each of these was somewhat lobulated, six or more inches in length, three or four inches in diameter, and smallest at its neck. The dissection was carried downwards and backwards between the bulb of the urethra and the rectum, each of which was exposed, and through the triangular ligament. The starting-point of these lobulated tumors was discovered to be fan-shaped and expanded, high up between the prostate gland and the rectum, where ligatures were passed around their two pedicles and the masses were cut away.

These tumors are interesting for their insertion deep in the ischio-rectal fossa, which was doubtless their place of origin. The microscope showed them to consist of a fibroid structure, with some attempt at an elongated cell growth. Lying free within the skin and not involving it, they differ from a similar structure which is occasionally found attached to and corrugating the skin itself. Examples of the latter kind exist in elephantiasis of the scrotum, and also in some other outgrowths, of which the following is an example.

Case III.— *Fibro-cellular Tumor growing from the Skin.*

The patient was a young woman, twenty-five years of age, and the tumor was of six years' duration when it was removed, in August, 1856. She was troubled only by the weight of the mass, which was suspended from the upper part of the left buttock by a large pedicle, the whole weighing after removal thirteen and one half pounds, and being well represented in the accompanying wood-cut. The surface of the tumor was discolored, as in elephantiasis, wrinkled

and lobulated, but perfectly flaccid. A few days' confinement to the bed reduced the size of the tumor and rendered



the whole mass softer, so that it was evident that the growth owed something of its size and induration to œdema from being suspended when the patient occupied a standing position. The discolored and lobulated investments of the tumor terminated abruptly at their margin in the healthy skin.

After excision the wound measured about thirteen by seventeen inches, and the patient, although much prostrated by the operation, finally recovered. Microscopic appearances as in the preceding case.

This winter (1863–64) I again examined this patient, and found the tumor beginning to reappear.

UNUNITED FRACTURE SUCCESSFULLY TREATED; WITH REMARKS ON THE OPERATION.[1]

THE following paper gives the details of eleven consecutive cases of ununited fracture successfully treated, with the exception of one in which the bone was diseased. Such continued success justifies the belief that the operation about to be described will effect the desired object with more uniform certainty than any other method now in use.

Having failed in a number of cases to effect a union of ununited fracture of the humerus, by rest, compression, blisters, seton, drilling, excision, dovetailing, etc., and having in mind the experiments of Ollier[2] for the production of bone from periosteum, I determined when the opportunity presented to avail myself of the osteoplastic function of this membrane. In trying the experiment for the first time (February 14, 1860), I was not aware that any previous attempt had been made to produce bony union of ununited fractures by preserving the periosteum for that purpose; but in the ensuing spring, at the time of the successful issue of the case referred to, I happened to meet with a paper recently published upon this subject, a superficial perusal of which seemed to show that its author had covered the ground at least of novelty in the method. The pamphlet was mislaid, and I thought no more of the matter, although I had frequent occasions to repeat my operation, with successful results, and annually referred to the subject in my lectures before the Med-

[1] Boston Medical and Surgical Journal, May 16, 1867.

[2] Gazette Médicale, 1859, nos. xiv. and xv.

ical Class of Harvard University. A report of this method was also published[1] incidentally in connection with the testimony of the writer in a suit for malpractice, and afterwards mentioned in the London Medical Times and Gazette,[2] in which I stated that my own operation had been anticipated abroad. Within a few weeks my attention was directed, by my able house surgeon, Mr. R. H. Derby, to the following paragraph in Holmes's " System of Surgery ": —

"Jordan ascribes the failure of resection to the removal of the periosteum. He therefore by means of some blunt instrument, as the handle of a scalpel, dissects this membrane from the portions of bone which he is about to remove, and leaves the two empty pouches, passed one within the other and in some cases connected by suture, to form new bone. The suggestion is undoubtedly theoretically sound. Its practical value, however, remains to be proved. In two of the three cases which Jordan records, it failed of success; and he admits its failure in the hands of M. Sedillot." [3]

Upon again examining more carefully the original paper of Mr. Jordan,[4] I find that his method differs so essentially from my own as to explain both the failure of two out of three cases cited by him, and the almost uniform success of the cases reported in this paper.

1. In the method of Mr. Jordan, no means is taken to secure the perfect and permanent coaptation of the bones, — a measure which underlies the favorable issue of the whole proceeding, — if we except a suture of the periosteum, which is wholly inadequate to that object, and which must also give

[1] Boston Medical and Surgical Journal, October 15, 1863, p. 219.

[2] February 6, 1864, p. 155.

[3] Vol. i. p. 804.

[4] Traitement des Pseudarthroses par l'Autoplastie Périostique. Par Joseph Jordan, F. R. C. S., Chirurgien en Chef de l'Hôpital de Manchester. Paris, 1860.

way in a short time. This omission alone is fatal to any considerable success in the operation.

2. The muscle is detached from the periosteum,[1] and the periosteum then pounded to detach it from the bone, measures tending materially to devitalize the tissue upon which success most depends.

3. Mr. Jordan believes that suppuration hinders bony union, and therefore ingeniously modifies the whole operation for the purpose of preventing a suppuration which is in reality inevitable, and must therefore be met and provided for, controlled and directed, and which does not impede the desired result.

It may be added that an oblique section of the already tapered bone, as recommended by him, and especially the *rabbet*,[2] is not to be advised, as it tends to impair the vitality of the broken extremities; and, finally, that an apparatus of plaster is hardly sufficient to insure subsequent immobility, while one of gutta percha, by confining transpiration, is irritating to the skin.

The chief cause of ununited fracture is undoubtedly the severity of the local injury, although perhaps the constitution of the patient or an obliteration of the osseous artery may in a few cases have to do with it. It occurs in bones which have been run over, or after accidents from machinery which bruise and devitalize the injured part. The obstinacy and persistence of this lesion under treatment are well known, and have arrested the attention of surgeons, who have devised many expedients, though often unsuccessfully, for its relief.

In performing the operation which I have found to be so efficacious, the extremities of the false joint are to be attacked where they approach nearest to the surface, unless vascular

[1] See Plate III. of Mr. Jordan's pamphlet.

[2] An interlocking, called also in carpentry *rebate*.

or nervous trunks are in the way; in the arm, in all the cases I have seen, upon the outside; a free incision being contrived in each case with especial reference to the ready exit of pus. The musculo-spiral nerve, which is often displaced and tied down by lymph, is to be carefully looked for and avoided, and were it not for the precaution here requisite the bone might be exposed by a single incision. The principal bony extremities being found, the interval, which is sometimes quite irregular and interlocked, is gradually divided, and the ends turned out, the dissection being materially aided by an assistant, who powerfully flexes the false joint. As it yields, care is taken to prevent the muscles from being stripped from the periosteum, which they adhere to and aid in nourishing. When one extremity is fairly exposed, a crucial or other regular incision is to be made in the ragged callus which overlies the periosteum at its tip, which should be then seized by strong toothed forceps, and efforts made to tear it out of the rugous inequalities of the formerly inflamed bone. After a little delay and dissection, the flaps begin to yield; with some coaxing, the terminal adhesions are detached, and the sound bony shaft is reached, where the periosteum is only too easily stripped from the bone, requiring great care lest the shaft should be denuded higher than the intended section. The soft tissues being now protected by spatulæ or flexible strips of copper, the end of the shaft is removed by a common saw, the length of this fragment being determined by the amount of periosteum it has been necessary to detach. Half an inch of good cylindrical periosteum, with as much more of ragged tissue hanging at its extremity, has usually covered from three quarters of an inch to an inch and a half of bone. Perhaps half an inch of sound shaft, including the irregular or conical tip, which varies in extent, is a good rule of length for the excised piece in most cases. The other extremity is now to be

turned out and treated in the same way, and this terminates the dissection, leaving only the wire to be inserted. For this purpose holes are bored in each extremity with a good bone-drill, larger than the wire, at a little more than half an inch from the end, and through one wall only. A pure silver or plated copper wire is inserted from without inward in one end, and inversely entered from within outward in the other; the size of the wire ordinarily used is No. 10 of Stubbs's iron wire gage. The ends of the bone are brought together accurately, and the two ends of the wire twisted until the twist is long enough to protrude at the external wound. The incision is then brought together by sutures, leaving an adequate exit for pus, and the apparatus is applied.

I have found, on the whole, that the best apparatus for the humerus, when that bone has been the seat of the operation, consists of a firm concave splint of iron and leather, made to fit the top and outside of the shoulder as low as the axilla, and thence horizontally to the neck, and secured by a strap around the opposite axilla; a similar gutter to receive the elbow and forearm flexed at a right angle; and the two united by a narrow iron strap on the back with another on the front of the humerus, adjustable as to its length. The splint can be thus shortened when in place, so as to keep the extremities of the bone in contact, and is nearly immovable in spite of the great leverage of the arm upon the wire, while the dressings can be readily applied in the open interval without disturbing the arrangement.

For the femur, a pasteboard splint may be moulded to the anterior aspect of the thigh and leg, and then stiffened with dextrine, an interval for the wound being left. The whole limb is then secured to this by bandage, and, surmounting the whole, a Smith's anterior splint is applied, by which the leg is suspended from a railway on a framework over the bed.

I have usually employed water dressings at first, and poultices or oakum to absorb the discharge afterward. The patient has remained in bed for several weeks, and in fact till some stiffening has taken place, after which fresh air has been enjoined as an invigorating and osteoplastic agent. The diet has been as generous as the appetite would permit, and the phosphates have been generally administered upon the principle of giving egg shells to hens.

The wire has remained in place until the bone was firmly united, generally during several months, and there has been in no case evidence of any ill effects from its presence, either in producing necrosis or undue inflammation. In fact, it has in some cases remained quietly in place after the arm was in use, and until the patient returned for its removal. In Case II. the wire remained for two years.

To remove the wire, the loop is best divided with cutting pliers, and forcibly drawn out; hence an advantage in flexible wire. This loop is sometimes quite superficial, but in other cases is so deep as to require an incision to reach it.

It may be remarked that a partial stiffening, dependent on the inflammation of the soft parts, may take place in a few weeks, but the bone afterwards becomes gradually loose if the periosteum fails to do its duty.

The one great point to be observed in treatment is the prevention of abscess, or, in other words, the early and free evacuation of imprisoned pus, by large and dependent incisions, which here as elsewhere are incomparably less injurious to the tissues than the burrowing of pus. Again, the formation of an abscess is always attended with fever, which destroys appetite and weakens the patient. Hence especial vigilance is needed to detect any inflammatory induration supervening after suppuration has begun, and the first decided pointing should be the sign for an opening, to be explored by

the finger, and enlarged inside or outside accordingly. I need not say that it is, in general, cruel to use the knife without an anæsthetic, but here the careful exploration and the tearing of the adjoining sinuses with the finger, if adequately done, absolutely demand it, for the comfort of both surgeon and patient. In a long experience, I have never seen a patient, unless already moribund, really worse for ether, but I have often seen a weak person prostrated by the excitement and suffering of an operation, when it was withheld by the timidity or haste of the surgeon. As for freezing, it is sometimes more convenient for short and superficial incisions and in private practice, but when the novelty of this method has passed by it will yield to general anæsthesia.

In operating upon the humerus, the musculo-spiral nerve demands particular consideration. Winding around the outside of the arm near the usual place of incision, it is sometimes difficult to avoid, especially when displaced by the deformity and tied into an indurated mass of lymph. I have twice accidentally divided it, in spite of more than ordinary care; once completely, and once leaving only a single fibre at one side. In the first case, an operation had been undertaken only a month after a previous one, while the arm was still inflamed. It was on that account absolutely impossible to keep the wound dry, and during a protracted dissection the knife was at last used beneath the blood; the nerve was imprisoned and concealed in a deep groove in the new bone, and was divided in separating the bones. On this ground, I should not advise a second operation until the traces of active inflammation from the previous one had disappeared. In this last case the neurilemma was reunited by a small suture. In both, the power of the paralyzed extensors ultimately returned, completely and unequivocally. In a third case, now under treatment, partial paralysis ensued after the operation, but the nerve had been nowhere

seen, and could hardly have been divided. Here, however, the fragments were so short that a powerful and continued effort had been required to make their ends protrude, jamming the muscles in their interval, and very likely thus injuring the nerve. The fingers are now regaining their motion. In this instance, which was a gun-shot wound, the operation failed twice, there being still some necrosis about the bone, of which the lower fragment was enlarged to at least double its normal diameter. In future, under similar circumstances, I should consider the operation contra-indicated, unless there appeared to be no good chance of getting rid of the necrosis by time or interference. Other things being equal, it is better to wait unnecessarily.

The case most favorable for operation is undoubtedly that of a healthy subject, where the bony extremities are of natural size. In an ununited fracture of long standing, atrophy tapers the bones, and in consequence obliges more extensive excision.

The only instance I have encountered of ultimate failure was one of extreme softening of the bone by interstitial absorption, a condition which was not ameliorated by invigorating measures, including the free and protracted use of the phosphates.

Case I. — *Humerus.*

E. J., aged twenty-two, entered the Hospital on October 14, 1857. Eleven months before, his right arm was caught in a "splitting machine," and drawn in between the cylinders. A compound comminuted fracture of the radius and ulna was produced at about their middle, and a compound fracture of the humerus rather below the middle. The fracture of the humerus did not unite, that of the forearm did.

October 15. A seton was passed between the fractured ends.

February 24, 1858. No union. Seton removed. Subsequently, emplastrum cantharidis was applied over the fracture; the ends of the bones were rubbed together.

May 12. No union. An incision was made over the fracture; the two ends were exposed, and an inch removed from each.

November 21. Patient was discharged, not relieved.

November 15, 1859. Patient returned to the Hospital; the arm was perfectly useless, and occasionally caused pain. He was prepared for anything that should offer a reasonable prospect of success, or even for amputation as a last resort.

December 17. Patient etherized, and, with the view of producing irritation, each fractured extremity was split with a pair of strong forceps, made for the purpose with chisel blades, which punctured the skin at opposite points, and slowly penetrated the bone, the handles of the forceps being compressed in a vise. A splint was applied, consisting of a shoulder-cap, with a band around the opposite side, and a cap for the elbow and forearm. These two caps were made to advance towards each other by a screw, so as to crowd the ends of the bones together.

December 18. Comfortable.

January 15, 1860. In consequence of pain about the shoulder, the apparatus was removed and the arm bandaged. Little or no union.

February 14. Patient etherized, and a crucial incision made on the external surface of the arm over the fracture. The band of ligamentous tissue connecting the bones was divided, and each extremity of the humerus turned out. The periosteum was carefully detached, for an inch or more, from each end. The denuded ends were then sawed off. A hole was drilled through each bone, and a stout silver wire passed through. The ends of the wire were then

twisted, and the extremites of the bone brought into exact apposition. The external wound was united with sutures, the wire was left protruding, and the former splint reapplied. After the operation, opiates were needed and freely given.

21. Wound smelling badly. A solution of chlorinated soda injected under the apparatus.

25. The apparatus was removed, washed, and reapplied.

March 5. Wound closing by granulation. General condition good.

23. Arm apparently stiff.

29. To-day the arm and shoulder becoming somewhat painful from pressure of splint and necessary want of cleanliness, everything was removed with great care; on slight examination of the arm, no motion was detected. The arm and shoulder were then carefully washed, lateral splints applied, and the hand and elbow supported in a sling.

April 4. The dressings were again removed. Slight mobility was detected at the point of fracture. As only six weeks had elapsed since the operation, it appears to have progressed as rapidly as any compound fracture of an equally severe character could be expected to do. External wound nearly healed.

23. Apparatus frequently removed. Union firmer.

June 13. Union being now very firm, and the wire causing some pain, there seemed to be no indication for its remaining longer. He was etherized; the wire was untwisted and removed.

July 1. Arm was stiff and strong, with considerable motion in the elbow.

July 12. At request, patient was this day discharged, being able to return to his work, which is that of a leather splitter. The arm appeared to be nearly as useful as the other.

Case II. — *Radius.*

A. D., farmer, aged fifty-six. Four years ago, he received a fracture of both bones of the right forearm, with other injuries, by being caught in machinery. Splints were applied and kept on for nine weeks, the patient being confined to bed on account of necrosis of both tibiæ resulting from the injuries sustained. At the expiration of this time there was no union. A starch bandage was applied and allowed to remain for four months, but still no union was secured. During all this period his health continued good. Nine months after the receipt of the injury, an incision was made over the lower border of the forearm, the ends of the fractured bones were turned out and sawed off, and the extremities wired together. Various other measures were subsequently resorted to, but with no success.

When admitted to the Hospital, February 6, 1861, the fractured ends of the radius could be felt distinctly; there appeared to be some ligamentous union in the ulna. He had a very considerable use of the hand.

February 9. Patient etherized; a tourniquet was applied over the brachial artery to keep the wound dry. An incision was then made along the upper border of the radius, about two inches in length. The ends of the bone were turned out, the periosteum was dissected up, and about half an inch of each fragment sawed off. A hole was now drilled through the upper wall into the medullary cavity of each end, and the ends of the bone firmly fastened together by means of a stout silver wire passing through the holes and twisted. Two small arteries required ligature. The edges of the wound were drawn together by sutures and a compress applied. The arm was placed in an external angular splint, and bandaged firmly to prevent motion.

12. The pain in the arm is quite severe and constant.

Considerable swelling about the wound. The bandage is daily removed.

March 1. Wound nearly healed about the wire. Appetite and strength excellent.

23. Allowed to go home, to return for the removal of the wire.

February 13, 1863. Patient has been able to saw wood with his right arm. He came to have the wire removed, which has remained in place since the operation.

14. He was etherized. An incision half an inch in length was made over the point of fracture; the wire was divided, and easily removed, two years from the time of its insertion.

CASE III. — *Humerus.*

J. C., laborer, aged twenty-four, entered the Hospital on November 4, 1861. Eight months before, while turning the crank of a hand-car, he became entangled in some way and his left arm was drawn under the crank and fractured above the elbow. A physician applied splints to the arm, and for two weeks took them off and reapplied them every day. At the end of eight weeks the splints were finally removed, but no union found at the point of fracture. Four months ago the fractured ends of the bone were rubbed together, but with no success.

Now the left arm is about one inch shorter than the right, the ends of the broken bone overlapping each other. The fracture extends from a point about four inches from the lower end of the humerus, on the outer side of the shaft of the bone, obliquely inwards and downwards, terminating at a point about two inches above the internal condyle. Crepitus and motion are very distinct. There has apparently been no callus thrown out round the fracture. Motion in the elbow joint is perfect.

November 9. Patient was etherized. An incision three and a half inches in length was made through the skin over the seat of fracture. The subjacent fibres of the triceps were then divided, as was also, accidentally, the musculo-spiral nerve, with the exception of a single fasciculus, by which its extremities hung together and which was afterwards carefully respected. The ends of the fractured bone were then turned out; the periosteum was carefully detached from both; a piece one and a half inches long was sawed from the lower fragment, and a piece one inch long from the upper. A hole was then drilled through each end of the fractured bone, and the two sawed surfaces kept in apposition by a silver wire passed through the holes and twisted. An inside and an outside angular splint, well padded, were then applied. A single suture was introduced to keep the edges of the wound slightly in apposition. The extensors of the hand are paralyzed.

13. Splints were removed and reapplied. Position excellent. Slight suppuration in wound.

16. Splints removed and arm dressed.

21. Slight paralysis of sensation on the posterior radial aspect of forearm, but no sensation over the back of thumb and radial side of forefinger.

29. Appetite poor. Pulse accelerated.

December 17. Slight stiffening at point of fracture.

27. Considerable stiffness in humerus. Wound nearly closed.

January 10, 1862. Union moderately firm.

March 1. On careful examination, a slight yielding was detected at the point of fracture.

11. A small piece of necrosed bone came away from wound.

May 10. Patient was etherized. An incision was made down upon the wire, which was then extracted.

22. Discharged, well.

This patient wrote, April 28, 1867, that he was a "section hand on the Northern Railroad," had not lost a day since he left the Hospital, and was "well, doing the hardest kind of work." Sensation and motion in hand perfect.

Case IV. — *Humerus.*

E. D., laborer, aged thirty-one, entered the Hospital on December 4, 1862. A year ago his left arm was caught by a revolving shaft and the humerus fractured. The skin was much contused but not perforated. A physician was called, who, after examination, pronounced the humerus comminuted throughout nearly its whole extent. He applied splints, bandages, etc., and on the third week reapplied them, at the same time making considerable extension to bring the fragments into position. At the end of the fourth week he announced that the union was getting firm, and a week later he removed the splints and applied strips of pasteboard. A few days after this, by a sudden movement, the fragments were displaced, although very slightly. After two weeks, by the statement of the physician, they had become firmly united again. In the middle of May, he reported that, although well united, they were not strong, and he applied bandages, etc., intimating that it would be a year before the bones would be firm enough to bear hard usage. Three weeks after this, the patient had the bandages removed to wash the arm, and his wife at once declared that the bones were loose. Various measures were then taken to procure union. For the past four months he has not interfered with the false joint, but has given his attention to recovering the motion of the elbow, stiffened by long disuse. The false joint is a little below the middle of the humerus.

December 6. Patient was etherized. An incision, four inches long, was made over the outer aspect of the false

joint, and the ends of the bones were exposed. Both were irregular in shape, especially that of the upper fragment. They were bound together by a tough pearl-colored gristly material, quite firm to the knife. The periosteum was dissected up and turned back from about an inch of each end; the bones were then sawed off square, and a hole bored at a point a quarter of an inch from the points of section. The two fragments were brought into apposition and held in place by a silver wire passed through these holes and twisted. The free ends of the wire were long enough to project from the wound. Sutures were then inserted, and angular splints, external and internal, were applied.

10. Suppuration well established. Splints removed, and wound dressed.

20. Has lost appetite during the last twenty-four hours. On removing splints, an erysipelatous blush was seen over the whole upper arm. ℞. Quiniæ sulphatis, gr. ij., three times a day. Beefsteak and wine, if he will take them.

24. Splints changed. Doing better.

January 2, 1863. Patient is quite strong and cheerful. On removing the splints to change dressings, considerable stiffness is found in arm. Suppuration is moderate; the wound is closed, except immediately about the ends of the wire.

4. Considerable pain at the point of fracture and in elbow.

14. Walks about.

16. The pus has burrowed towards the elbow. Much weaker. Beefsteak, wine and eggs.

23. There is tenderness and redness over the internal condyle, apparently from the commencement of a large abscess.

27. Patient has been very wretched since the last record, from great pain in the abscess. The splints were unbearable,

and were removed yesterday. The arm is laid on a large poultice, with an external straight splint. The abscess was freely incised under ether, and the various sinuses were torn into one.

31. Patient was etherized, and the wire cut and withdrawn.

February 4. Patient is improving wonderfully. He sits up all day, and walks about freely.

18. Wound entirely closed.

26. The arm is quite stiff at the point of fracture.

March 9. Discharged, well.

Case V. — *Femur.*

B. H., teamster, aged twenty-seven, entered the Hospital on March 10, 1863. Five hours before admission he was run over by a heavy team, the wheel passing over the middle of the left thigh. The whole of the left thigh is greatly swollen and ecchymosed, shortened about two and a half inches. The fracture is perhaps comminuted, and at the middle of the femur. Desault's apparatus was applied.

April 18. Comfortable since the last report. Desault's apparatus was removed to-day. Limb in excellent position. There is apparently considerable callus, but the thigh appears flexible at the point of fracture.

21. A starch bandage, stiffened with pasteboard, applied to the limb from the middle of the leg to the upper third of thigh.

30. Sits up daily.

May 4. Upon examination to-day, it was found that there was no union.

6. Desault's apparatus reapplied.

7. Apply over fracture emplastrum cantharidis (six by four.)

23. No union. Apply extension by weight.

August 1. Starch bandage was applied over leg and thigh. ℞. Calcis phosphatis, gr. x., three times a day.

15. The starch bandage was removed, and extension by weight reapplied.

September 2. After a careful examination, it was decided that there was no union at the point of fracture.

8. A starch bandage was again applied, and patient allowed to sit up.

December 5. No union. Patient etherized, and a seton passed between the fractured ends of bone.

16. Profuse discharge from lower wound.

27. Seton removed.

February 2, 1864. Discharge from wound diminished. Apparently but little stiffness.

June 4. Patient has continued in the same condition since the last record. There is no union. He was etherized, and the ends of the fracture were drilled in several different places.

18. There has not been the slightest inflammation in the thigh produced by the drilling.

July 20. There has been no change in the thigh since the last report. The ununited ends of bone are surrounded by a large amount of indurated tissue, which makes it very difficult to get at them. Patient etherized, and the ends of the bone were again and more thoroughly drilled. At most parts the bone was quite hard and normal, but at one point it was soft, and the drill on withdrawal was followed by quite a stream of oil from the degenerated marrow. The limb was placed in a straight splint.

November 4. There is no stiffness at the point of fracture.

12. The patient was etherized. A long semi-circular incision was made on the outside and back of the thigh, its convexity downwards, over the ends of the bone, to favor the discharge of pus. The muscles of the thigh were so

indurated that the ends of the bone were turned out with great difficulty. They were smooth, rounded, and conical. The periosteum was turned back for about one inch on each, and the bones, thus denuded, cut off with a chain saw. The medullary substance was slightly degenerated and fatty. A hole was drilled through each extremity of the bone, and a wire passed through these holes and twisted, not tight, but leaving a small space between the ends, to allow of sufficient motion to prevent breaking the wire or the bone. The periosteum was brought together and the wound closed by sutures. The limb was placed in a McIntyre's double-inclined iron splint, bent at an angle of 135°. The operation occupied about two hours, during which time the patient was kept thoroughly etherized. Cold water dressing.

13. Patient has considerable irritative fever. Pulse 132. Tongue thickly coated. The pain is relieved by acetate of morphia, one sixth of a grain, subcutaneously.

15. Much brighter. Pulse 100.

16. Suppuration has commenced.

23. The leg and thigh have remained until to-day on the McIntyre splint, but the suppuration has increased so much that it requires removal for daily dressing. A pasteboard splint has been moulded to the anterior and inner part of the thigh and stiffened with dextrine; to this the thigh and leg are firmly bound, leaving the wound open. In addition, a Smith's anterior splint was applied, by which the whole leg is swung from a framework over the bed.

27. The splint works admirably. Less pain. The wound looks well, and is suppurating freely. Appetite good.

December 24. The bandages and splints were removed and reapplied. There seems to be considerable stiffening, and the bones are in good position.

January 13, 1865. No motion is observed at the point of fracture.

February 12. The limb is so firm that it was laid on a pillow, with only pasteboard splints applied.

April 26. Under ether, the wire was cut down upon and removed.

May 17. Patient is up and dressed. Appetite and general health excellent. He wears a dextrine bandage for the support it affords him.

June 1. Walks about on crutches. The knee is quite stiff.

July 1. Wounds entirely healed. Motion in the knee is returning.

12. The femur is perfectly firm and free from pain. Patient furnished with a thick-soled shoe. Discharged, well.

November 10. Came to the Hospital to-day. Is able to walk without the aid of a cane. Not the least motion can be detected in the femur. The knee is flexible.

CASE VI. — *Humerus.*

T. C., soldier, aged forty-one, entered the Hospital on April 15, 1864. He was wounded by a Minié ball in the right humerus at the first assault on Port Hudson, summer of 1863. The bone was broken at about the junction of the middle and upper thirds, and was considerably splintered. According to patient's account, the surgeon sawed off about an inch from each end, and then approximated the bones by means of splints, but did not wire them. He was put in an ambulance, carried fifteen miles over a rough country, then in a steamer for some distance, and it was two days before he arrived at a hospital. The wound soon healed, but the bones did not unite, and have not since.

April 16. Patient etherized. An incision was made over the point of fracture. The ununited ends were forcibly everted. The periosteum was carefully dissected up and reflected, and the denuded portions sawed off. A hole was

drilled through each end of the fragments. A wire was then passed through these holes and twisted. The periosteum was brought together, and the wound closed by sutures. The arm was placed in an outside angular splint.

20. The arm has slipped from the splint, and is quite out of position, so that the ends of the bones are at a slight angle with each other. The angular splint was removed and the arm placed on a broad straight splint, with two shorter side splints to keep the fragments in place.

23. The wound is suppurating freely, and the arm is in good position.

May 2. The wound has nearly healed, except at the point where the wires emerge.

June 10. Patient walks about the yard, with the arm firmly supported. There is considerable firmness at the point of fracture.

24. The arm is stronger. Discharged.

September 17. Patient returned to the Hospital to-day with the arm so strong that he can use it for all ordinary purposes. The wire was removed, and the humerus was found to be perfectly firm.

December 16, 1865. The arm is perfectly firm, and for some time he has done a great deal of heavy lifting, such as wheeling coal, without favoring the injured arm in the least.

Case VII. — *Humerus.*

E. S., female, aged forty-five, entered the Hospital on November 10, 1864. She had an ununited fracture of the right humerus, the result of a compound fracture received a year and a half previously. Seven months after the accident there was no union at the point of fracture. A seton was passed between the ununited ends, and allowed to remain for a month. Notwithstanding this and other forms

of treatment, no union followed. On entrance, there was a fracture of the humerus in its lower third; the ends of the bone were drawn widely apart by the weight of the forearm, unless held in place by an apparatus which she had worn for the previous seven months. She was a large, corpulent woman, with flabby tissues.

November 19. Patient etherized. An incision three inches long, was made on the outer and posterior aspect of the arm, just above the external condyle. The ends of the fragments were then turned out, the periosteum was dissected back for about an inch and a half on the lower fragment, and two inches on the upper. The denuded bone was then sawed off, the upper fragment by a single stroke of the saw. The bone was much atrophied, softened and degenerated, the holes for the wire being easily made with an awl, and the bony tissue easily cut with a knife. A wire was then passed through the outer sides of the shaft of the bone, and twisted so as to bring the ends nearly but not quite in apposition, lest the tight wire should break the bone. The edges of the wound were brought together with sutures, and the arm placed in an inside angular splint.

P. M. The arm is so unwieldy that it cannot be sufficiently confined in the inside splint. It was therefore laid on a flat right-angled splint.

27. Pulse and appetite good. Wound clean, and suppurating healthily.

December 30. ℞. Calcis phosphatis, gr. x., three times a day.

January 7, 1865. The wire has apparently torn out of the bone. No stiffening at point of fracture.

March 20. No union.

April 1. Patient was etherized. An incision was made down upon the bone, and the wire was removed. The ends of the fragments were turned out and found so degenerated

that they could easily be broken with the fingers. Forearm œdematous and tender.

26. The arm was amputated, at the patient's desire. The end of the upper fragment was removed.

May 21. Stump has nearly healed.

June 17. Discharged, well.

Case VIII. — *Humerus.*

W. W., carpenter, aged twenty-eight, entered the Hospital on January 2, 1865. Left humerus fractured twelve weeks before entrance, by the falling of an elevator in the Pacific Mills. The fracture was simple, and treated in the usual way with splints, but never had shown any disposition to unite. On admission, an ununited fracture of the left humerus was found at a point a little below its middle. The ends of the fragments were in apposition. Syrup of the hypophosphites, ʒij., three times a day.

January 7. Patient etherized. A narrow-bladed knife was pricked through the integument and muscles to the bone, at the seat of fracture. A small drill was then introduced through the wound, and each end of the bone was drilled in three places. The arm was placed between an inside and an outside angular splint.

26. On removing the splints, no union was detected.

February 25. Patient was etherized. A straight incision was made through the integument, on the outside of the arm, down to the bone. The musculo-spiral nerve was so drawn out of place and embraced by the bone that it was accidentally divided in the blood which welled up from the tissues, still inflamed from the operation of six weeks before. The periosteum was dissected from the ends of the bone, which were then everted and sawed off. A piece half an inch long was taken from the upper fragment, and three quarters of an inch from the lower. A hole was then drilled through

each bone, and a silver-plated copper wire passed through and twisted. A suture was taken in the neurilemma of each end of the divided nerve and its extremities brought together. Several arteries were tied, the wound was closed by sutures, and the arm placed in an inside angular splint, to which it was first firmly bandaged, and then placed upon a flat angular splint reaching from shoulder to hand.

26. Complains of great numbness over the dorsal surface of thumb and index finger, and has general paralysis of the extensors of the wrist and fingers.

March 3. Wound suppurating healthily.

8. Hand considerably swollen, and elbow looking angry and red. The wound is everywhere open. The suture applied to the neurilemma came away to-day. ℞. Pil. ferri iodidi, gr. v., three times a day.

16. Wound closing.

31. Considerable stiffness at point of fracture.

May 6. Humerus quite stiff.

25. But little discharge from sinus about wires. Appetite and general health excellent.

June 24. Under ether, the wire was untwisted and withdrawn. The humerus is perfectly stiff. Sensibility has returned to the thumb and index finger, but motion in all the extensors of the hand and wrist is absent.

March 17, 1866. Patient reported at the Hospital to-day. He has worked at his trade since last August, without inconvenience. Motion in the extensors of hand and wrist has returned perfectly. The humerus is entirely firm, and free from pain.

The union of the musculo-spiral nerve, which was com pletely divided and brought together by suture of the neurilemma, and the restoration of its function, are points of great interest.

CASE IX.— *Humerus.*

T. G., laborer, aged twenty-six, entered the Hospital on June 12, 1865. A year before entrance he was thrown from a hand-car, one wheel of which passed over the middle of the right humerus, inflicting a compound fracture. The arm was placed in an inside angular splint, and kept in position for six weeks. The external wounds healed readily. At the end of this time, the arm was again broken at the original point of fracture, and has never united.

June 21. An incision three inches long was made on the outer aspect of the arm, over the seat of fracture. The musculo-spiral nerve was then sought, carefully dissected in its sheath from the bone, and turned aside. The periosteum was stripped back from the end of each fragment. A piece half an inch long from the lower, and three quarters of an inch from the upper bone, was sawed off. The ends were then drilled on the outer side, and a silver wire passed through; the bones were placed in apposition, and the wire twisted by four half-turns. The arm was placed in the same apparatus as that used in the previous case. The edges of the wound were brought together by sutures.

23. Apparatus reapplied. The bones are in good position. Some œdema of the arm.

27. Suppuration is established. ℞. Calcis phosphatis, gr. x., three times a day.

July 3. The arm is much swollen about the wound, and covered with an erysipelatous blush. Patient complains of some headache and nausea. ℞. Quiniæ sulphatis, gr. ij., three times a day.

10. The swelling and redness have disappeared. No union at point of fracture.

28. An outside angular splint was applied, the arm supported by a leather sling, and patient allowed to sit up.

August 7. Apparatus removed and reapplied. There is slight stiffening at point of fracture.

22. Only slight motion can be detected in the humerus.

September 11. The arm is stiff, but patient complains of pain at the seat of fracture when it is examined.

November 4. All discharge and soreness having disappeared, and the humerus being perfectly stiff, a pair of curved scissors was thrust down, the wire cut close to the bone, and easily withdrawn.

December 15. The humerus is firm. Discharged, well.

Case X. — *Humerus.*

W. M. W., carpenter, aged thirty-three, entered the Hospital on January 26, 1866. He was wounded with a Minié ball at the battle of Gettysburg, and suffered a compound comminuted fracture of the right humerus. July 5, the bone was resected and about three inches removed. The wound healed in five months, after exfoliation of the sawn extremities of the humerus. No attempt was made to keep the bones in apposition, and no union was obtained. He resumed duty and served out his full time with his regiment. The wound has never reopened or caused him any trouble. Now several inches of the middle of the right humerus are gone, and the two extremities can be felt, pointed and considerably absorbed. The whole arm is quite small from disuse. The motion in the shoulder and elbow is perfect, but the arm hangs useless from the loss of substance in the shaft of the humerus.

January 27. Patient was etherized. A longitudinal incision was made over the ends of the fragments. The end of the lower fragment was then everted; the periosteum was carefully detached for a sufficient distance and turned back, and half an inch was sawn off from the end of the bone, which was firm and healthy. The upper fragment was

treated in the same way, but its end, three quarters of an inch of which was removed, was degenerated and quite soft. The two ends were then drilled; silver wire was inserted and the bones approximated, leaving a small interval to allow slight movement. The periosteum was returned to its place, a few vessels were tied, and the external wound partly closed by sutures. The arm was placed in an internal angular splint. Water dressing.

30. The arm is in excellent position. Suppuration is beginning.

February 21. A large abscess above wound evacuated itself to-day.

March 11. Patient walks about every day. Apparently some stiffening at the point of fracture.

17. An abscess is forming on the inner aspect of arm.

20. The abscess was opened and discharged freely.

31. The humerus is quite firm. Patient discharged to-day to return once a week.

April 27. Scarcely any motion can be detected at the point of fracture.

May 23. An incision was made down upon the wire, which was cut and withdrawn. The union of the fractured ends is firm. The apparatus was removed. Patient returned to work.

Case XI. — *Humerus.*

P. M., laborer, aged twenty-three, entered the Hospital on January 12, 1867 He was wounded at the battle of Cedar Mountain, 1862, by a musket ball. The left humerus was shattered at a point a little above its middle. The small pieces of bone were removed, the ends sawed off. and the fragments approximated. Six months later there was no union; the ends were again sawed off and the bones wired together. At the end of two weeks the wire was removed.

In October, 1864, a number of pieces of necrosed bone were removed from the seat of fracture; there was no union. In November, 1865, he entered the Hospital. The left humerus had a false joint at its middle. There was necrosed bone in the lower fragment at the bottom of a couple of sinuses. An incision was made over the fracture, the periosteum reflected, and the ends of the bones were sawed off. In March, 1866, there was no union. March 31, the periosteum was again detached from both fragments for a sufficient distance; about one and a half inches were sawed off from the lower, and one inch from the end of the upper fragment. The ends were drilled, silver wire inserted, and the fragments placed in apposition. The periosteum was then replaced and its edges were united by sutures. April 28, the arm had stiffened at the point of fracture. June 10, he fell upon the arm and broke it. July 15, he was discharged with an ununited fracture, to return when the arm looked and felt better.

January 12, 1867. Patient was etherized. An incision three inches long was made over the outer aspect of arm and carried carefully down to the point of fracture. The two ends were found to be much roughened. Great difficulty was experienced in everting the ends of the now short fragments, and in detaching the periosteum. The bone was finally separated from the periosteum for a sufficient distance, and one inch was sawed from the upper, and three quarters of an inch from the lower fragment. The lower fragment was two inches in diameter; the upper one was of normal size, but with fatty degeneration of the marrow. A hole was drilled through the sides of both fragments; a silver wire was inserted; the bones were placed in apposition, and the wire twisted. The periosteum was replaced, and its edges were united by sutures. The external wound was partly closed by sutures. A folded towel was placed in the axilla to lift out the short upper frag-

ment, and the arm secured to the side, the forearm across the chest.

13. There is almost complete paralysis of the extensors of the fingers of the left hand. No nervous trunk was known to have been divided in the operation, and the paralysis is perhaps due to a compression of the nerve in very forcibly everting the shortened fragments.

21. The arm was placed in an apparatus, which consists of a firm cap about the shoulder, secured by a strap around the chest; this is made firm by two steel bridges to a splint that invests the forearm like a coat sleeve.

27. The arm remains in excellent position. The power of extension is returning to the fingers.

February 3. The wound is contracting by healthy granulation.

6. Slight stiffening at point of fracture.

16. ℞. Calcis phosphatis, gr. x., three times a day.

March 4. Allowed to walk about.

April 16. The humerus is quite firm at the point of fracture. Patient flexes the forearm and raises the humerus from the side freely.

22. Discharged, probably well, although sufficient time has not elapsed to determine the fact.

As will be readily inferred, this humerus was materially shortened by these consecutive operations, two before entering the Hospital, and three subsequently by myself. In fact, by measurement the arm was *seven inches* shorter than its fellow, yet the biceps and triceps were fulfilling their functions, and the patient was regaining excellent motion. There can be no comparison in the value of an arm of this sort, however short, and an ununited humerus. At the first operation, and during the existence of undefined necrosis, the bony tissue of the lower fragment was of a reddish hue, and of a dense, brittle, and amorphous texture, such as is

sometimes observed in the denuded walls of the cavities of sequestra when chiselled. At the end of about a year, at the next operation, when the probe no longer detected dead bone, I was agreeably surprised to find that this tissue had given place to a comparatively healthy one, with cancellated interior.

Conclusions.

1. This operation is a successful one.

2. Though not a trifling operation, it is not dangerous.

3. In the operative procedure the points deserving attention are: the *incisions*, which should be arranged for the free escape of pus; the *periosteum*, which is not to be detached from the muscles, and which, after being incised, should be torn out from the rugous inequalities of the bony extremity, and subsequently connected by suture or not; the excision of at least a quarter of an inch of sound cylindrical *bone* in addition to the irregular and tapering end; the *wire*, which should not be twisted too tightly, lest it break out of the bone.

4. The wire may be allowed to remain indefinitely, without danger of necrosis, and usually until union has unequivocally taken place, — a period of from two to six months.

5. Burrowing pus is to be evacuated when it approaches the surface, in such a way that the wound will insure its free and permanent exit.

6. The patient is to be invigorated by such food as he bears, fresh air, and other stimulus if required.

7. The operation may be repeated if it fails, but only after several months' interval.

RECAPITULATION.

Case.	Bone.	Cause of Injury	Duration.	Wire Remained	Result.	Remarks.
1	Humerus.	Arm caught in a splitting machine.	3 years.	4 mos.	Well.	Seton; blisters; rubbing ends of bone together; excision of ends of fragments.[1]
2	Radius.	Arm caught in machinery.	4 years.	2 years.	Well.	
3	Humerus.	Arm caught in a hand-car crank.	8 mos.	6 mos.	Well.	Rubbing ends of bone together.[1]
4	Humerus.	Arm caught by a revolving shaft.	1 year.	2 mos.	Well.	
5	Femur	Crushed by a heavy team.	20 mos.	5½ mos.	Well.	Blisters; seton; drilling ends of fragments twice.[1]
6	Humerus.	Gun-shot wound.	11 mos.	5 mos.	Well.	
7	Humerus.	Compound fracture.	18 mos.	4½ mos.	Amputation.	Softening of the bone.
8	Humerus.	Arm struck by a falling elevator.	5 mos.	4 mos.	Well.	Drilling ends of fragments.[1]
9	Humerus.	Crushed by wheel of hand-car.	1 year.	4½ mos.	Well.	
10	Humerus.	Gun-shot wound.	5 years.	. . . .	Well.	Excision of ends of fragments; excision of ends and wiring fragments; two operations by Dr. Bigelow.[1]
11	Humerus.	Gun-shot wound.	2½ years.	4 mos.	Well.	Excision of ends of fragments.[1]

1 Previous operations, which had failed.

PERIOSTEAL REPRODUCTION OF BONE.[1]

I. — Of the Condyles of the Humerus after Excision of the Elbow Joint.

Case I. — September 14, 1857. O. P. F., aged twenty-nine, married, clerk. Is a light-haired, unhealthy-looking man. Family liable to scrofulous affections. Five years ago, while at work hoisting goods, he struck his right elbow a violent blow, causing great pain. The elbow swelled, and he was laid up a fortnight. Since that time, whenever he struck this joint, it would swell up in a similar manner. Last July a fistulous opening appeared a little outside of the olecranon, and a week or two later a second one broke out about two inches below the first. These discharge a thin, purulent fluid. A probe passes under the skin from one opening to the other. No diseased bone is felt.

From this date until March 27, 1858, the record states that various sinuses formed and were laid open.

March 27. Etherized. An incision was made over the olecranon, exposing a cavity in the bone with carious walls the size of an almond. The diseased parts were removed by the gouge.

28. Very little pain. Doing well.

April 21. Abscesses continue to form.

June 19. Patient etherized. Joint opened by a semicircular incision, and the ulnar nerve sought and turned

[1] Boston Medical and Surgical Journal, May 30, 1867.

aside. The ends of all the bones were found to be much diseased, and about an inch of the ulna and an inch of the humerus were removed. The head of the radius was also excised. But little blood was lost. No arteries tied. The periosteum, being firmly attached to the coral-like surface of the bone, was torn out from the inequalities with strong forceps. Wound brought together by sutures. Flaps riddled by old fistulous openings. Arm placed on an angular splint, with water dressing. — Evening. Very little pain. Skin warm. Pulse 100. No hemorrhage.

22. Edge of wound looks sloughy. Comfortable. Stitches removed.

26. Pulse good. General condition as good as before operation. Edges of wound have opened and sloughed. Sinuses clean. No pain. Porter.

August 17. Wounds closing slowly. Discharge much diminished. Appetite good. Walks out every day.

22. Wounds flabby. No dead bone felt. Strap.

September 5. General health is very good. Ulcers have contracted somewhat. Advised to go into the country, and is discharged.

November 11, 1858. Since leaving the Hospital patient has been in the country. Looks as well as when last seen. About a month after his discharge, an abscess opened, two inches below head of radius. Now integument around elbow is red and inflamed. There are five fistulous openings which connect with one another and centre in a cavity formed by the removal of the bones. No dead bone can be felt. The discharge is very slight. No pain. Still keeps on the angular splint. Has made up his mind to have the arm off, and enters for the purpose of operation. House diet. Ale. Poultice.

16. Has more or less cough. Cod liver oil, two drams thrice daily.

20. Patient was etherized, and the arm amputated just above the elbow.

February 28, 1859. Discharged, well.

It has lately been ascertained that this patient, who manifested indications of tubercular disease of left lung before his arm was removed, died of phthisis about December 1, 1859, the disease not having been arrested by the amputation.

The interesting points in this case of excision of the elbow joint are: —

The reproduction of the condyles of the humerus by the periosteum, which was torn from the interstices of the bone of both the original condyles. The horns which were reproduced for the insertion of the extensor, supinator, and flexor muscles are conical processes, each somewhat more than half an inch in length, and regularly curved forwards and inwards, as seen in the above wood-cut made from a

photograph of the parts removed. The rugous surface of the excised condyles is also well shown.[1]

The unfavorable issue of this case corroborates what seems to be a fact; namely, that while the elbow is a most favorable joint for excision in cases of recent injury and in healthy subjects, yet when this articulation — so near the centre of the circulation, and which is therefore well nourished, and should be prompt to take on reparative processes — becomes carious from disease, it implies a general feebleness of constitution, and indicates the propriety of amputation rather than excision.

II. — Periosteum of the Forehead Transplanted in a Rhinoplastic Operation.

Case II. — December 1, 1866. A. B., aged twenty-two. This young woman, at the age of ten years, was attacked with scrofulous lupus, which resulted in the destruction of the principal part of the nose, including the bones and as far down as the alæ. A hole of the size of a silver dime, surrounded with cicatricial tissue, exposes the nasal cavity. The margin of the alæ remains half an inch wide and retracted into the cavity of the nose, especially upon the right side.

15. The alæ were dissected from their adhesions within the nasal cavity, and, being cut square, left a margin a quarter of an inch in width. A flap was taken from the forehead, in the usual way, and brought into place so as to form a nose and unite at its lower margin with that of the alæ and septum. In dissecting up the flap, the periosteum to which it was attached was carefully removed from the skull, in the hope that it would form a new bridge.

16. Wound looking well.

[1] For a somewhat similar specimen, from the practice of Professor Syme of Edinburgh, the reader is referred to the Lancet, March 3, 1855.

19. Every other suture removed.

25. It is now evident that the exposed bone is becoming necrosed.

March 2, 1867. The margins of the wound upon the forehead have shown little tendency to approximate over the exposed surface of bone, the whole of which is dead, and is becoming gradually elastic and detached from the subjacent tissue. To-day (eleven weeks after the operation) forceps were introduced at the edge of the wound, and the entire bony surface lifted off in two fragments, being itself a scale of almost papery thinness, and uncovering a healthy granulating base.

31. Patient was etherized, the pedicle divided, and the eyebrow restored to its normal position.

April 30. Wound of the forehead completely healed.

May 15. No bone can be detected in the new nose.

Having, in four preceding instances, had occasion to make an entire new nose from the forehead, and having been on the whole dissatisfied, owing to the tendency of the new nose to flatten, with the want of resemblance in the result of my own efforts to the model nose usually depicted in standard works on surgery as the result of the rhinoplastic operation, I determined in this instance to invoke the aid of the periosteum in the formation of a new bridge. This had already been done abroad; with what result, I have been unable to learn. I had, however, been previously deterred from the experiment, in apprehension of the very injury to the bone which has been mentioned as having occurred in the present case. The necrosis of the whole surface of the exposed bone, in connection with the entire absence of osseous formation in the new nose five months after the operation, is not favorable, so far as the evidence of a single case may be relied on, to a repetition of this experiment.

FRACTURES AND DISLOCATIONS OF THE ELBOW JOINT.[1]

THERE is no class of injuries so frequently productive of discontent, and perhaps so often the cause of litigation, as the traumatic lesions of the elbow joint. The fractures of the elbow are especially common in children; and the surgeon is often called upon, some six or eight weeks after the accident, to say whether the elbow has been properly set. Although he should uniformly refrain from expressing an opinion which cannot be given without a full knowledge of the circumstances under which the patient was treated, and although it is at that interval of time occasionally impossible to say exactly what the original injury was, yet he is often led to the painful conviction that the result might have been better if certain simple rules of treatment had been rigidly adhered to. These rules are often lost sight of; they do not receive that prominence in books which the importance of the subject demands. It is also a fact that a fracture of the elbow joint, especially in a young person, may pass for a sprain, because it fails to exhibit any marked signs upon a casual inspection, — because the pain may be slight and the swelling such as to mask, in some measure, the character of the injury. The medical attendant, after examining the arm, has perhaps enjoined great care, bandaged a compress upon the parts with cooling applications

[1] An Abstract of a Clinical Lecture, March 2, 1868, entitled "Practical Views of the Treatment of Fractures and Dislocations of the Elbow Joint, and on the General Impropriety of Passive Motion." Boston Medical and Surgical Journal, May 7, 1868.

or liniments, and, visiting it daily, has been surprised at the end of four or five weeks, when the swelling has subsided, to find an unusual stiffness of the joint, — in fact, an impossibility of flexion or extension, — and, what is of more importance, a hard prominence in the bend of the elbow, suggestive of serious displacement. Such is the history of frequently recurring cases of injury to the elbow joint, resulting, not from a want of ostensible care or solicitude on the part of the attendant, but of an omission of one simple expedient in treatment, presently to be mentioned, and for the want of which deformity is imminent; although I incline to the belief that in a majority even of these cases a tolerably good joint is established in a young person after a lapse of years. I am speaking of the simple and not the compound fractures or dislocations of this joint, which are very serious injuries. Cases may also happen where the elbow is so excessively swollen before the surgeon is called that it may be proper to wait for the swelling to subside before applying the necessary apparatus; but even here the inflammation subsides more readily if the elbow can be properly set, and the very large majority of cases are not of this character.

The rule I would enjoin upon you is the following. Ascertain if the olecranon is broken, which can be done with comparative ease, as it lies near the surface. This injury requires a special treatment. In all the other injuries of the elbow joint, whether you are able to make an exact diagnosis or are wholly unable to do so on account of the swelling, *treat them as though the forearm had been dislocated backward, and secure the arm at about a right angle to an inside angular splint.* The propriety of this measure will not be doubted with regard to the more common dislocations of the arm. The very rare instances of the radius dislocated forward, or the all but impossible forward dislocation of the ulna alone, would doubtless declare themselves, and

the bones would be replaced during the manipulation. Practically speaking, they are so rare that they need not be taken into account. But among the fractures, the transverse fracture of the lower end of the humerus, the T fracture into the joint, the fracture of the inner or outer condyle separately, the comparatively rare fracture of the coronoid process of the ulna, or of the radius or ulna near the joint, are all properly treated by the expedient above described; while the common injuries of the lower end of the humerus, including the fracture of the internal condyle into the joint, peremptorily demand it. In these cases, it is sometimes difficult or impossible to make an accurate diagnosis; but the above treatment covers the whole of them, and does harm to none, while it is the omission of it, as I believe, that directly leads to subsequent deformity in a large proportion of them.

In a case of this sort, my advice is as follows. Always use ether, and avoid any painful examination whatever until the patient is fully under its influence. In providing the anæsthetic, I provide also an internal angular splint, knowing that the chances are ten to one that it will be required. After etherization, the character of the injury is determined as far as may be without unnecessary harm from manipulation of the parts, and, the elbow being placed at right angles, the wrist is drawn forward, while the humerus is pushed backward at the elbow, precisely as if a backward dislocation were being reduced. In this position it is forcibly maintained while the fragments are adjusted as accurately as possible, and an internal rectangular splint, padded by a folded towel, is applied by an assistant. To this the arm and forearm are now secured, the friction of the bandage of the forearm being relied on to prevent any backward displacement of the latter at the elbow. I need not say that a bandage is never to be applied before putting on the splint. An outside splint may

also be secured to the forearm, if thought necessary. A few inches of the arm above and below the elbow may be left uncovered for cooling lotions and especially leeches, if the swelling or superficial congestion make them advisable.

If the olecranon alone be fractured, a more or less straight position is usually advised. Do not suppose that, because the olecranon is fractured, it is drawn up the arm by the triceps muscle, as indicated in the plates. On the contrary, it is generally retained pretty nearly in its place by the lateral ligaments. A member of the class once asked me, "What if the olecranon and internal condyle be both fractured?" In reply, I should say, wait until it occurs. A semiflexed position might then be a compromise between a widened interspace at the olecranon and the far more serious deformity resulting from a displacement of the fragments of the humerus for the want of rectangular flexion. But in inventing an injury of such possible occurrence, do not lose sight, in the very frequently recurring fracture of the condyles of the humerus, of the absolute importance of drawing the arm forward at right angles, and confining it in this position by an internal angular splint. It is the tendency to backward displacement of the forearm that commonly leads to deformity in these cases.

Now let us suppose that a fracture of the elbow joint has been overlooked, and the arm placed in a sling, as previously described; or that a simple bandage has been applied to it, perhaps with leeches and cooling applications, and that everything but the proper thing has been done; or, indeed, that the injury has been so severe as necessarily to entail a very limited motion of the joint at the expiration of perhaps four to six weeks. Consult the books upon the subject, and you will there find that it is necessary, after this interval, to commence what is called *passive motion*, which is generally of a pretty active character. I hold this teaching to be radi-

cally wrong; and that such passive motion, as a rule, besides occasioning the patient excessive pain during the operation, or, if done with ether, a good deal of discomfort afterwards, is productive of more harm than good. It begets active inflammation, and is a serious injury to a part which is under repair, and which nature in its own good time will restore better without than with. More than this, I believe that the time lost by the necessity of rest during these inflammatory attacks counterbalances any time supposed to be gained by pumping the joint, lacerating the bands of recent lymph, compelling the stiffened ligaments to bend, and otherwise doing violence to the still inflamed and tender tissues. I speak now of the pain and inflammation liable to be awakened; but there are other injuries which may occasionally happen in passive motion of the elbow joint. Among them, the most frequent is the separation of the olecranon, especially when that was a part of the original injury. On this account, I have sometimes been careful, when passive motion seemed to be called for, rather to extend than to flex the limb, or at any rate to flex with great caution. The fragments of the humerus, when they have not been properly replaced, not only occasion a stiffness which has been considered especially to demand passive flexion, but unfortunately become too solidly united in their new position to allow of their displacement, or of material benefit to the arm by this violence to the joint. If, when the splint has been removed at the proper interval for repair (from four to six weeks), the arm can be flexed or extended through even a very small arc, not with that deceptive springiness due to the elasticity of the ligaments, but in a way to satisfy the surgeon that the cartilages are sliding one upon the other, however little, my rule is to leave the rest to nature, with entire confidence in the result: allowing the patient to take off his splint daily and as he pleases, to flex and extend the arm

as the pain and tenderness may allow him, encouraging him in his attempts to reach his forehead with his hand. I have also often advised a patient to bore holes in a soft board with a small gimlet, to increase the power of rotation. But if the cartilages do not slide through even a small arc, and motion is restricted, elastic, and springy owing to bony deformity, so much the worse for the patient, and so much the more remote and less perfect the recovery. I do not believe you can accelerate it by passive motion, as the term is usually understood; you give the patient a good deal of suffering and the joint a good deal of inflammation. If these views of passive motion are correct, the teaching of the books should be received with considerable qualification.

The exception noted above, in which passive motion is undoubtedly advantageous, is when the bones are in place, the articular surfaces in shape, and the arm stiff from being too long kept in splints; but this is only likely to occur after an interval of months, just as the arms of Indian fakirs are said to become anchylosed by being maintained for years in one position. I had a lady brought to me, who, having lost sight of her medical attendant, and feeling her elbow a little sensitive after a fracture, had kept a splint on for more than three months. The elbow was of normal shape, with little or no tenderness, but was stiff, and there was virtually a false anchylosis. When the muscles were relaxed by ether, a little motion was discoverable, as is usual in cases of false anchylosis; and, with the application of moderate force, the bones of the forearm were made to sweep around the articular surface of the humerus, as in a healthy joint. This sliding of a healthy cartilage contrasts strongly with the unyielding springiness and elasticity where bony deformity exists. It characterizes the case which passive motion benefits, where all motion has been accidentally prevented for months, and where there is no deformity of

the articular surfaces. Exactly how far these observations on passive motion apply to the knee and other joints and injuries, I will not attempt now to define, but can only say that I have seen more harm than good arise from forcible flexion of the knee after rheumatism and after fracture of the shaft of the femur.

In simple fractures of the elbow, except of the olecranon, my remarks may be summed up as follows. Always etherize the patient, go through the motions of reducing a backward dislocation of the forearm, and apply an internal angular splint. When there is bony deformity or projecting callus, passive motion does harm; when the bones are in place and under supervision, it is unnecessary.

CLEFT PALATE.[1]

In exhibiting a plaster cast of a cleft palate recently operated upon, I would direct attention to a mechanical expedient for aiding union of the palate in the operation of staphylorrhaphy, first employed, so far as I know, in this case. Before doing this, it may be well briefly to review the deformity and the operation for its relief.

The cleft may be median or lateral. It is either a continuation of a hare lip, or exists independently. In the latter case it may involve both the hard and soft palate; or only the soft palate may be affected, and, in cases very favorable for operation, to an inconsiderable degree. The result of this deformity is chiefly noticed in the nasal intonation of the voice, to correct which various expedients have been proposed. The name of the late Dr. J. Mason Warren is associated in this community with many of our earlier operations, and I think that to him is fairly due the original suggestion of freely liberating the soft palate by dissecting it from its upper attachments before drawing together the margins thus liberated. This is perhaps the great improvement of the modern operation.

I am not aware that Dr. Warren described the anatomy of the parts thus detached. This was afterwards done by Mr. (now Sir William) Fergusson, who, having examined the cleft palate of a dead child, demonstrated that the malformation involved a contraction of the levatores palati,

[1] A Clinical Lecture, delivered on December 21, 1868. Boston Medical and Surgical Journal, February 4, 1869.

and sometimes of other muscles. I do not know that this distinguished surgeon detached the flaps in a way which practically differed from that repeatedly accomplished by Dr. Warren, but, having described anatomically the parts thus dissected, his name is associated with this feature of the modern operation. The late Dr. Warren was impressed with the belief that a large majority, if not all, of the subjects of this operation were materially improved, if not cured, of their nasal voice. A case of my own, fifteen or more years ago, led me to scrutinize this point more narrowly, and I was led to the conviction that, although a patient occasionally shows a remarkable improvement in speech, the rule is the other way. Neither can improvement be always expected at once, but only after a lapse of sufficient time to allow the parts to become flexible. The case I have just mentioned was that of a young lady, in whom the nasal intonation was very marked, and in whom the only apparent deformity of the palate was a partial cleft of the uvula alone. The palate was ample, and to appearance well under muscular control, and yet this congenital deformity of a bifid uvula was associated with an imperfection in the mechanism of articulation, which months of effort on her part, even after the fissure was closed by operation, failed to overcome. This case established the fact that something is wanting for perfect articulation beyond a palate of normal size and appearance; and that although the lateral flaps of a cleft in the soft palate may be attached to each other, often with a result beautiful in appearance, it does not therefore follow that the nervous and muscular action will be perfectly restored. In the case of a wide fissure extending well forward through the bone, the soft parts are actually insufficient to restore the palate, and then the usual result of the common operation is a band of greater or less width tightly stretched by cicatricial contrac-

tion across the palate, bounded behind by a naso-pharyngeal chasm which it is insufficient to close, and in front by a fissure in the bone which still remains. It is difficult to say that the phonation of such patients is not improved a little; they are, indeed, generally inclined to flatter themselves with this belief after an obturator has been adjusted to the bony opening. A patient with palatine fissure, in articulating the words *bad man* says *man man*, vainly trying by facial distortion to occlude the anterior nares; while a patient with nares occluded by a tumor, or a cold in the head, says *bad bad*, or *beautiful bood*, as in the familiar poetry of "Punch." Between the nasals *m*, *n*, and *ng*, on the one hand, and the labials *p*, *b*, the linguals *t*, *d*, and the gutturals (improperly so called) *k* and *g* hard, on the other, pronounced with occluded nares, there is a wide difference; and perfect articulation requires the machinery for enunciating at will both sets of consonants. This the healthy palate supplies in opening and hermetically closing the posterior nares. Yet there are persons with sound palates who habitually talk through the nose, as the conventional Yankee is said to do. Such persons do not make efficient use of their levatores palati and superior constrictors of the pharnyx. While we may hope to approximate our patients to the normal condition of such persons, it should be remembered that a very small communication with the nasal fossæ may materially modify the intonation. The nasal quack to the duck, for example, is produced by the reverberation of a comparatively small elastic cavity; and a hole in the human palate a quarter of an inch or even less in diameter may produce the same result. It cannot be denied, however, that a very marked improvement now and then results from this operation, especially in a favorable case; and in view of this possibility it is certain that patients will continue to demand it at the hands of the surgeon.

The expedient to facilitate union of which I have spoken consists in the employment of a temporary artificial palate, in this instance of hard rubber, to protect the parts during cicatrization. Its use was suggested to me by Dr. Beach as a means of shielding the tongue from metallic sutures, and thereby enabling the surgeon to employ them conveniently in this operation. It also occurred to me that this arrangement would protect the palate from the peristaltic action of the tongue in swallowing, and other involuntary movements which endanger union. It is pretty well established that the success of the modern operation for vesico-vaginal fistula mainly depends upon the use of metallic sutures, planted near together so as to insure close contact of the wound, which cause an irritation so inconsiderable that they can be left in place from one to two weeks. Similar advantage ought to accrue from their use in the palate. The hard rubber palate here shown was made by Dr. Sheppard, Adjunct Professor in the Dental School of this University, and fitted so as to cover the whole region occupied by the palate after the operation. It conforms with the arch of the normal palate, leaving an interval of about a quarter of an inch between it and the mucous membrane. Behind, it bends down just far enough not to incommode the tongue, while in front it was keyed in the interstice of the incisors left by the former hare lip, and laterally attached by silk threads to a tooth on each side. The whole is made as accurately as if it were a plate for false teeth. A hole near the front admits the nose of a small syringe, by which the interval between the plate and palate was syringed with warm water twice daily. In this case I cannot doubt that the contrivance was of service. The fissure was wide, reaching to the incisors. The flaps were detached well forward from the bone, and seven fine silver stitches were inserted. The plate was not removed for the examination of the parts until the eighth

day, when every stitch was found in place and was removed, the union being perfect. During the succeeding week the contracting cicatrices at the margin of the wide fissure of the bony palate drew apart a quarter of an inch of the anterior extremity of the wound, which is less than usual in these cases. The width of the remaining band was about one inch and a quarter, which, considering the size of the palate, is more than we could have expected. I cannot but think that, whatever the operation upon the palate, a more perfect union will be secured by silver sutures thus protected than by the ordinary method.

It remains to notice some of the expedients which have been of late years adopted in connection with this operation. One of the most valuable of these is the so called "gag" of Mr. T. Smith, of London, a steel instrument by which the jaws are effectively kept open, and the tongue at the same time depressed, so that the parts are fully exposed, and the operation can be performed with great facility under ether, even in young subjects. This one has been fully tested in the operations of staphylorrhaphy, excision of tonsils, etc., with ether, during the past few months, at the Massachusetts General Hospital, and the operation above described was performed with its assistance.

Much attention has been directed to the different methods of closing the openings behind and in front of the transverse band of varying width which results from the union of the soft palate in large fissures. This has been usually effected by an obturator. I have not met with as good results as many writers declare they have obtained, by an operation which consists in simply detaching the soft tissue from the bony margins of the anterior fissure. Of this tissue Langenbeck says that it is "more fragile and more adherent to the periosteum as we approach the gums: in fact, you can only borrow autoplastic flaps with a chance of success

from the posterior part of the mucous membrane, the thickest and least adherent, especially that which covers the horizontal plates of the palatine bones." But there can be little doubt that by detaching this flap we secure a union of the soft palate to a point a little farther forward than might otherwise be possible, and so facilitate the subsequent use of an obturator. A later operation, usually attributed to Langenbeck, is said to be much more effectual in closing the anterior fissure. It consists in denuding the whole horizontal bony palate, and uniting upon the median line the soft tissue thus detached. A good idea of this method may be obtained by supposing two large lateral flaps to be thus formed from the whole soft and hard palate combined. The tissue is best detached from the bony palate by square or spade-pointed blades inclined to their handles, by which the membrane is cleanly dug or hoed from the bone. After starting it, blunt instruments work best. Such flaps are still insufficient anteriorly, and a lateral incision is therefore made on each side, close to the alveolar processes, from the second incisor nearly to the last molar. These incisions stop in front at the incisors, and behind near the hamular processes, in both cases before reaching the bony canals of the arteries. Thus the arteries of the flaps are preserved, before and behind, and the flaps are wholly detached from the horizontal bone, except at three points, the anterior attachment being a pedicle. The lateral incisions are usually made first, and the process of detaching the soft parts is there begun and continued inward toward the median line. When the fissure is wide, and one or both sides of the bony palate nearly vertical, the lateral incision may not be needed. The anterior fissure thus occluded by obturator or membrane can have no immediate influence in bad cases upon the pharyngeal opening, although it is quite probable that after a lapse of time the elastic membrane will insure

a more flexible soft palate and a better phonation than an unyielding obturator.

M. Passavant, of Frankfort, in a paper on the means of obviating the nasal intonation in congenital fissures of the bony and membranous palate, etc.,[1] after speaking of the inefficiency of present operations in attaining this result in a majority of instances, cites a case of much improvement after an operation in which the posterior border of the soft palate was attached to the pharynx behind it, the surfaces being first denuded and then placed firmly in contact by means of sutures. This result, however, was only attained at the expense of a transverse incision of the soft palate, by the gaping of which the palate was brought into contact with the pharynx. I ought here to add that, within a few months, I have attempted this operation in one instance without liberating the soft palate by a transverse incision, and that in this case the pharyngeal border failed to unite. But it seems not improbable that these and other comparatively recent investigations will lead to some operation to be performed under ether, (with the invaluable aid of the "gag" above mentioned,) which may so far occlude the nasal cavity, or shut it off from that of the mouth by a flexible septum, as to insure in bad cases an improvement of the voice, which now only happens occasionally. It is probable that the combined hard and soft rubber palate, alleged to afford relief in these cases without an operation, would be even more efficient as the results of surgical interference become more complete.

It remains only to describe the common operation. If ether is not to be used, the patient should educate the soft palate to insensibility for a few days by frequently tickling it with a feather. The best way to hold the soft palate for dissection is with double hooks terminating in firm single

[1] Archives Générales de Médecine, 1865.

points, meeting and crossing a little. A single puncture is thus made. Common forceps slip, and tear and bruise the parts. I divide the muscles until the flaps are free, using scissors doubly curved on the edge and flat, one for each side, passing the finger occasionally behind the flap to find where it is most tense and unyielding. The edges are now to be pared; this incision bleeds least, and is therefore perhaps best done first. The whole thickness of the edges of the palate should be included, and if there be doubt upon this point, owing to the discoloration of the parts, the detached sliver may be floated in water to see if it is of uniform width. Further dissection may be made before or behind at discretion, and the parts brought together by common small curved needles threaded with silk or wire; then each suture, to facilitate finding it again, has its ends united, and each is drawn in succession through the fissures of a plate of cork, cut like a comb and held on the forehead of the patient. The needle-holder should not have jaws more than a quarter of an inch wide, — otherwise they will straighten a curved needle, — and not extending more than half an inch beyond the pivot, so that the long handles may secure a firm grip. The best needles are the smaller sizes of glovers' needle, curved with different bends, the temper being then partially restored, and their shanks flattened by grinding or honing, to prevent them from turning in the forceps. The silk sutures are tied with common knots; or the wires with a half knot and then a twist, and are to be left in place until union is perfect, or as long as they are of any service.

PRACTICE IN PRONUNCIATION.

Chart to be used by Patients after an Operation for Cleft Palate.

The great difficulty in pronouncing correctly with a cleft palate is to distinguish the nasals from the mutes, thus: *p* and *b* from *m*, pap or bab from mam; *t* and *d* from *n*, tat from nan; *k* and *g* (hard) from *ng*.

"Tar" is well pronounced by most beginners with an obturator. When the beginner can pronounce "stark" and "car," he has the key to most of what here follows. These words should be practised carefully; not "start" and "tar," but "stark" and "car"; and should be spoken loudly, or, as the elocutionists say, "exploded."

1. tar	artar	kar	arkar	kar
ark, ache;	take, steak;	took, cook;	talk, cork;	caught.
2. kar	arkar	arkgar	kgar	gar
3. kar	arkar	arktar	ktar	tar
4. kar	arkar	arkdar	kdar	dar
5. kar	arkar	arkpar	kpar	par
6. kar	arkar	arkbar	kbar	bar
7. kar	arkar	arklar	klar	lar
8. kar	arkar	arksar	ksar	sar

Practise all the above with the following vowels:—

9. *o* as in coke.

Thus, instead of kar, akar, etc., ko — oko — oklo — klo — lo.

10. *a* (long) as in cake.
11. *i* as in kite.
12. *e* as in keep.
13. *u* as in suit.

14. kar	arkar	arngar	arkar	arngar	kar	ngar
15. tar	artar	arnar	artar	arnar	tar	nar
16. par	arpar	armar	arpar	armar	par	mar
					bar	mar
					dar	mar
					sar	rar

Practise reading loudly from a book.

TURBINATED CORPORA CAVERNOSA.[1]

THAT the turbinated bones are embedded in erectile corpora cavernosa is a fact of interest to both surgeon and physician. But that this simple and satisfactory explanation of the every-day phenomena of a "cold in the head" has not yet passed into current science is sufficiently shown by the little attention given to the subject in most standard modern works of descriptive anatomy. Venous congestion, dilated veins, veins resembling sinuses, venous plexuses, etc., are sometimes briefly spoken of as explaining the singular tumefaction of the Schneiderian membrane during inflammation; but very commonly this membrane, as a locality of erectile tissue of any sort, is ignored altogether.[2]

[1] Boston Medical and Surgical Journal, April 29, 1875.

[2] It is a little curious that Rouget, who has made an elaborate study of erectile organs makes no mention of the Schneiderian mucous membrane. (Du Tissu érectile, etc., Paris, 1856; Journal de la Physiologie de Brown-Séquard, vol. i., 1858; Comptes Rendus de la Société de Biologie, 1857; Des Mouvements érectiles, Archives de Physiologie Normale et Pathologique, 1868, p. 671.)

Eugene Boeckel, in the Nouveau Dictionnaire de Médecine et de Chirurgie Pratique, Paris, 1870, tom. xiii. pp. 721, 722, in an extended consideration of the subject, states, as the result of his own investigations and those of Kobelt, that erectile tissue is confined to the genital apparatus, male and female, internal and external; but that Rouget, who "considers as erectile every organ in which arterial or venous plexuses are submitted to the action of smooth muscular fibre, . . . finds erectile tissue" not only "in the wall of the vagina, the uterus, the substance of the broad ligaments, and in the wing (*aileron*) of the ovary," but also "in the iris." The Schneiderian membrane is omitted in this enumeration.

Many years ago, while examining for operation the cleft palate of a patient who happened to have a catarrh, I was attracted by the excessive turgescence of the mucous membrane on and about the inferior turbinated bone; but yet more, when it suddenly collapsed like the lung of a small animal. Remarking then to an assistant that this phenomenon was much more suggestive of the action of erectile tissue than of merely vascular congestion, I have since not unfrequently ventured to tell some suffering doctor that he would find upon the inferior turbinated bone an erectile tissue to elucidate, if it did not alleviate, his symptoms. Having, during the last year, examined the tissue in question myself, I am able to identify a remarkable and well formed cavernous structure, at least upon the inferior and middle turbinated bones.

The difference in the size of the distended and collapsed cavernous bodies is quite striking, and is best seen upon the

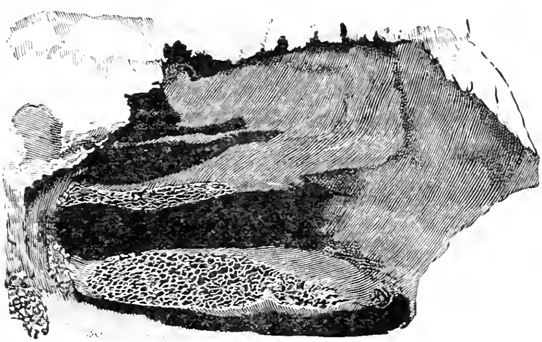


FIG. 1.[1]

inferior turbinated bone. Collapsed, the outline and dimensions are nearly those of its attenuated bony framework. Distended, it becomes an angry, turgid mass, of uneven

[1] Upper jaw showing sections of turbinated corpora cavernosa, inflated and dried.

surface and livid color, completely closing the lower nostril. A pouch-like process projects from the rear of the bone, increasing its length, and with the aid of a blowpipe readily showing to the naked eye, on section, the cavernous cells. It is this reticulated pouch that is seen with the mirror at the back of the nares.[1] Above it is seen the middle turbinated mass, similarly distended; and if the injection of the whole membrane is considerable, the nasal septum also swells to the thickness of nearly one quarter of an inch,

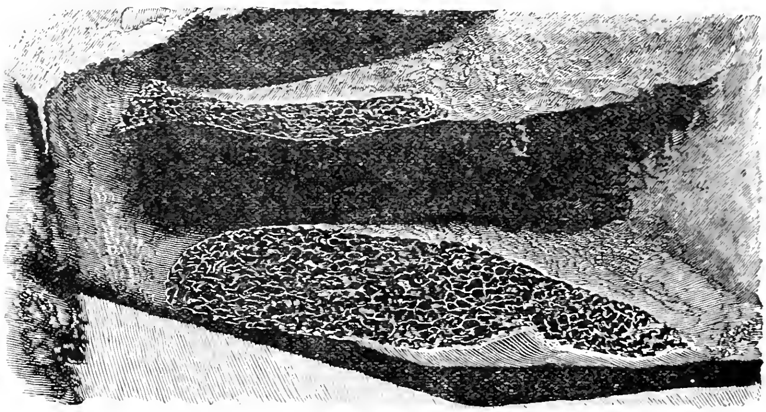


FIG. 2.[2]

especially near its posterior edge (Figs. 1, 2). With a little mucus in the interstices, the nostril is thus completely obstructed, the opposing surfaces doubtless producing by their firm contact the sense of weight and pressure frequently experienced during the progress of a "cold." A depression in the bony septum sometimes corresponds to a protuberance of the cavernous tissue as if it had yielded to repeated pressure.

[1] For a description of some of its various appearances, see paper by Dr. Cutter in the Boston Medical and Surgical Journal, vol. lxxiii. p. 397.

[2] The same as Fig. 1, magnified two diameters.

If inflated and dried, the cells project upon the surface. A section (Figs. 1, 2, and 3) then gives further evidence of a cavernous structure, with closely juxtaposed cavities tolerably uniform in size and equally distributed, approaching quite nearly both the mucous surface and the bone. They commu-

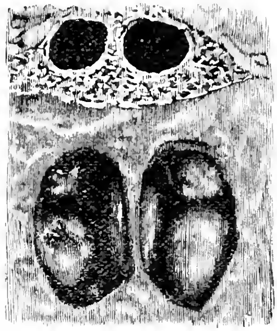


FIG. 3.[1]

FIG. 4.[2]

nicate by irregular apertures, while minute bands and septa traverse and connect their common walls. A wet microscopic section (Fig. 4) exhibits thin trabeculæ and walls, composed mainly of connective tissue, presenting cavities of unequal dimensions, and closely resembling the cavernous structure of the penis, although the

[1] Turbinated corpora cavernosa injected with gelatine and seen from behind. The injected and thickened septum is also seen.

[2] Section of posterior extremity of a turbinated corpus cavernosum, hardened in alcohol, treated with iodine and glycerine, and magnified ninety diameters, showing cavities, walls, and trabeculæ. For this section I am indebted to Dr. A. N. Blodgett, and for the drawing to Dr. Quincy.

smooth muscular element and the tunica albuginea of the latter are somewhat more pronounced, as might be antici pated from the comparative erectile tension of this organ.

The opaque and bulbous termination of a "helicine artery," once supposed to be characteristic of erectile tissue, is considered by Stricker to be only an accidentally folded extremity of a "vascular loop." It is figured as a dilated loop in Todd and Bowman's Anatomy and Physiology (1856, p. 6), where the drawing is taken from the olfactory membrane of the human fœtus. Observers differ about the dilatation.

Everybody is familiar with the firm and sudden impaction of the nose in acute catarrh, and has learned that a swallow of water, a pinch of snuff, a sudden start, mental or physical, often clears the passage, to be again filled up. Medical men have usually taken for granted, as a satisfactory solution of these phenomena, the existence of a "congested mucous membrane"; and to explain this, allege an exceptional vascularity of this membrane, numerous and large veins, "venous plexuses," "cavernous venous plexuses," any one of which would be in fact sufficient to distend a loose texture.

It is plain that either of the structures here enumerated might be artificially distended by the anatomist, with fluids or with air. But let it be remarked that, if what is designated as a "venous plexus" resembles the choroid plexus, it consists of a bundle or skein of hollow loops or vessels, inside of which the blood circulates as usual, and is not a tissue of solid trabeculæ outside of which the blood collects in irregular cavities, as in the corpora cavernosa and spongiosa of the penis. In short, while obstruction of the nasal fossæ is familiar, explanation of its machinery has been neither uniform nor wholly satisfactory.

In the following quotations from the principal anatomists who have given attention to this subject, it will be found

that the erectile action is attributed to the existence of a "venous plexus" or of a "cavernous venous tissue," — in short, to enlarged vessels rather than to well developed "corpora cavernosa." Even Kohlrausch, — the chief authority on this point, whose early investigations best cover the ground and are most quoted, — figures only a section of distensible loops and veins traversing a dense structure in which they are separated from each other (Figs. 5 and 6). I have become acquainted with these various investigations for the first time in looking up the subject since my own preparations here figured were made.

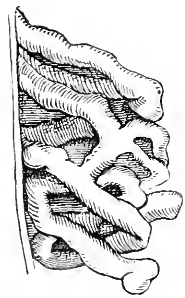


Fig. 5.[1]

Hyrtl, to whom Kohlrausch refers, says, "The veins of the mucous membrane form plexuses which remind one of the relation of the veins in the cavernous bodies."[3]

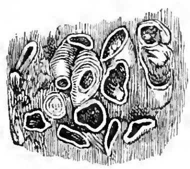


Fig. 6.[2]

Kölliker affirms that "the thickness of the mucous membrane of these parts is not solely dependent upon the glands, but also particularly on the edge and the posterior end of the lower turbinated bone, and upon the abundant venous plexuses of almost cavernous character discovered by me in the interior of the same; so that a sort of erectile tissue exists here."

Lastly, in Müller's Archiv (1853, p. 149) occurs the communication from Kohlrausch mentioned above, and from which the following is taken: "The simplest means of per-

[1] (From Kohlrausch.) "Venous loops" injected.

[2] (From Kohlrausch.) Section of venous loops, showing the so called "cavernous venous tissue" and "cavernous cellular tissue" of Kohlrausch, consisting of "firm cellular tissue uniting vascular loops."

[3] Topographical Anatomy, i. 285.

suading one's self of the presence of this cavernous venous network, which is particularly developed upon the posterior portion of the turbinated bone, is by inflating it with air. By hardening such an inflated preparation in alcohol, we may get very good sections for observation. This cavernous venous tissue is beautifully injected at times, when the injection succeeds, by inserting a tube in one of the jugular veins. From such preparations the drawings (Figs. 5 and 6) are taken. The venous network, joined throughout by abundant anastomoses, lies between the periosteum and the mucous membrane, and is everywhere, in a distended condition, $1\frac{1}{2}$–$2'''$ thick. The venous loops, in their main direction, are vertical to the bone, showing in the injected condition, a thickness of $\frac{1}{6}$–$\frac{1}{3}'''$, and have tolerably firm and thick walls. A firm cellular tissue unites the vascular loops with one another, so that on section we see merely a cavernous cellular tissue; we can obtain such a specimen (Fig. 6) only by a careful and successful experiment."

It would seem from this description that Kohlrausch, observing that the turbinated tissue could be inflated with air, endeavored to throw into it a common injection from the jugular vein. This injection failed to reach the cavernous cells. But it did distend veins and loops which were adopted and figured by Kohlrausch as the mechanism of erection. These veins and loops represented, as he erroneously supposed, the structure he had previously observed, on section, in the alcoholic preparations, and are offered by him as such.

It will be perhaps conceded that physicians are not generally familiar with this anatomy, of which they will readily make a practical application; and lest injustice should be done to the investigations of twenty years ago, the text and figures of Kohlrausch are here carefully reproduced.

NEW METHODS IN THE TREATMENT OF EXSTROPHY OF THE BLADDER AND OF ERECTILE TUMORS.[1]

1. — Exstrophy of the Bladder: Operation.

This operation consists in removing the exposed mucous membrane of the bladder, so that flaps drawn from the adjacent skin may adhere directly to its raw surface. In the case detailed below, the mucous membrane was removed down to the ureters. Flaps drawn from the sides were then united on the median line. Union was solid in about ten weeks. The usual surgical resource for this sad malformation has been an attempt only to cover the mucous membrane. But it would seem better to obliterate it by one and the same operation than to form a cavity which is worse than useless, because it collects the salts of the urine.

The usual operation, of which a case is given below, also needs a more extended dissection. It requires that a first flap be turned down upon the bladder from above, the object of which is to secure a lining of skin for the new cavity. This flap is covered with two others drawn from the sides and united upon the median line. The denuded surface from which the first flap was taken is then similarly closed by further dissections. By the operation now proposed, both the first flap and the dissection for covering the surface which supplies it are unnecessary. In both operations flaps are best cut where the skin is most relaxed. Hence it is better to include in the incisions the loose integuments of

[1] Boston Medical and Surgical Journal, January 6, 1876.

the groin, and even of the scrotum. The edges can then be brought together in any direction in which the flaps yield most readily.

In a third case cited below, where the bladder (open over the pubes) still presented a cavity, I was able to close this, so that by wearing a truss-pad the patient could retain urine for two hours. This case, however, was not one of complete exstrophy like the others.

I am indebted to Dr. H. H. A. Beach for the following abstract from the hospital records.

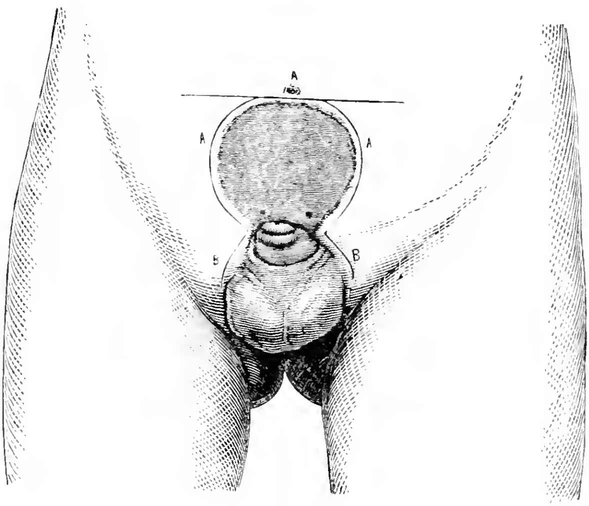


Fig. 1[1]

Case I. *Complete Exstrophy: New Operation.*— E. C. A., six years old, presented a complete exstrophy of the bladder, which was wholly exposed over a surface of two and a half inches; the skin was tense and the abdominal wall thin. The testicles were still in the inguinal canal.

[1] Exstrophy of the bladder. Lines of the incisions. In uniting them over the dissected surface of the bladder, the points *A A A* were brought together, and the points *B B*: the skin more readily yielding in a direction obliquely upward.

December 13, 1874. Operation under ether. The mucous surface of the exposed bladder was carefully dissected off, and the lateral flaps, including both inguinal regions, were united upon the median line and transversely above it. Sixteen silver sutures were introduced, and a piece of adhesive plaster was placed over the whole to keep the parts immovable (Fig. 1).

December 14 and 15. Patient doing well, with little pain.

December 16. A good deal of swelling about the wound, with a small slough near its upper extremity, where urine oozes.

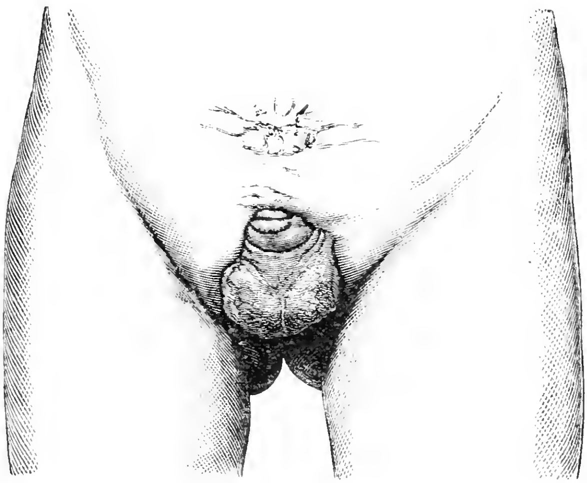


FIG. 2.[1]

December 18. Pulse 140. Temperature, A. M., 101°; P. M., 103°.

December 21. Twelve sutures removed.

December 22. Remaining sutures removed.

December 25. Patient doing well. The wound is healed, except at its upper extremity, where there is a little discharge.

[1] Photograph after the parts had healed.

January 22, 1875. A small abscess is forming under the flap. Patient has had a slight convulsion.

January 25. Abscess discharged through one of the needle holes.

January 26. Edges separated a little by ulceration at the upper extremity.

March 1. Patient is running about.

March 12. Photograph taken.

April 10. Union solid and no tenderness remaining.

May 7. Discharged, well (Fig. 2).

CASE II. *Complete Exstrophy: Old Operation.* — C. P., aged seventeen, entered the Hospital with complete exstrophy. Above the symphysis was a pulpy vascular and florid swelling, two and a half inches in diameter, formed by the protruded mucous surface of the posterior wall of the bladder. The umbilicus was wanting; no hernia existed, and the testicles had descended. The surface was very sensitive and tender, the penis rudimentary, with a complete epispadias. The urine, distilled from the ureters, fell upon the urethra, which served imperfectly as a spout. The patient was anxious and suffering. A shield covering the part caused excoriation.

June 2, 1868. Operation, under ether. A transverse incision midway between the bladder and the sternum, with vertical incisions at its extremities, surrounded three sides of a flap, of which the hinge was next the bladder. The flap was turned down over the bladder as far as the penis. Additional transverse incisions were now made, and four side flaps were dissected up, two of them abreast of the bladder, and two on a level with the wound from which the first flap was taken. These four flaps were now drawn to the median line and united, two serving to cover the raw surface of the inverted flap, and two that of the region from

which it was taken. The wound was everywhere closely united by silver sutures.

June 3. Patient quite comfortable, sleeping in a sitting posture to encourage the escape of urine. Flaxseed tea and milk *ad libitum*.

June 7. Doing well. Appetite good. Takes an opiate at night. The parts in the neighborhood of the wound are carefully washed night and morning, the salts of the urine removed, and the skin protected by castor oil.

June 11. Half the silver sutures removed.

June 16. Patient sits up nearly the whole day, and has an excellent appetite. Flaps are united beneath, while the edges are looking well, though there is little union by first intention.

June 18. Sutures all removed. Patient says that he is much more comfortable than before the operation. The most troublesome feature of the case is the deposition of salts of the urine upon the scrotum.

June 26. Margins pretty well united. All the urine escapes just over the glans penis.

July 7. Doing finely. Walks about.

August 20. Cicatrization complete. Bladder wholly covered. Condition far more comfortable than before the operation. Discharged.

Case III. *Orifice above the Pubes: Operation.* — F. W., aged sixteen. Just above the symphysis pubis there exists an orifice almost an inch in diameter, circular, and in part occupied by a rudimentary glans penis. There are no herniæ, and both testicles have descended. In the erect posture the urine constantly dribbles away. When the patient is lying down the urine collects in the bladder until it overflows.

November 7, 1868. Operation, under ether. The edges

of the aperture and frænum were refreshed, dissected up, and joined with six silver sutures; the orifice was reduced so as to embrace tightly a piece of elastic catheter passed into the bladder.

November 11. Wound suppurating a little. Glans penis at times enlarged, and trying to escape through the small orifice left from the operation.

November 12. Catheter no longer worn. Union perfect. Urine escapes wholly through the small aperture.

December 30. Patient has a sharp attack of epididymitis.

January 2. Improving.

March. Patient discharged, well. Retains urine for two hours by means of an apparatus consisting of a truss spring around the pelvis, to the back of which a steel spring is attached passing between the legs and terminating in a pad which compresses the aperture in front.

II.—Erectile Tumors obliterated by Central Cauterization with Solution of Nitrate of Silver.

In each of the following instances erectile tumors of a formidable nature were easily obliterated by the injection, with a subcutaneous syringe, of a few drops of a solution (equal parts by weight) of nitrate of silver in water. If the tissues are firmly compressed about the orifice of the tube, after its introduction, an eschar of the solid tissues is produced, soon enveloped by coagulum adherent from inflammation, with general blood stasis in the neighborhood. While the eschar thus made is more distinct and firm than that by acid or by the perchloride of iron, the expulsion of the blood probably diminishes the danger of embolism. The ultimate result is abscess and solid cicatrization. The first of the following cases was one of a large and pendulous under lip, which was so solidified by a number of simultaneous injections that a V-shaped portion was finally removed from it. The second

was one of cirsoid aneurism in the cavity of the orbit, which could not have been treated effectually by ligature without sacrificing the eye.

CASE I. *Pulsating Nævus of the Lips and Face; Operation; Cure.* — A. E., female, aged thirty-six, has a congenital nævus, involving the whole of the chin and lower lip and the inside of the upper lip, with a claret-colored stain extending over both cheeks as far as the ears. The lower lip and the chin are largely hypertrophied and pendulous, pulsating when compressed.

November 24, 1868. Operation. The patient was etherized, and the inside of the whole upper lip strangulated by seven large needles carrying fourteen ligatures.

January 10, 1869. Wound of upper lip entirely healed and tissues contracted.

February 23. Operation. The patient having been etherized, a few drops of a saturated solution of nitrate of silver were injected by a subcutaneous syringe at eight several places in the thickness of the lower lip, the latter being compressed upon the point of the syringe during the injection.

February 24. The patient complains of pain extending down both sides of the neck. Lip much swollen.

February 28. Little pain; free discharge from the openings; lip swollen and hard.

March 5. Several small sloughs have come away, leaving cavities beneath the skin. From this time the lip contracted, puckering at the injected points until the whole was solidified.

April 6. Operation. The patient having been etherized, a V-shaped piece was excised from the centre of the lip, with very little hemorrhage except from the coronary arteries.

May 2. Patient was discharged with a lip of nearly normal size.

Case II. *Cirsoid Aneurism of the Orbit; Operation; Cure.* — H. McC., housemaid, aged twenty-five, noticed in 1868 a small pulsating swelling at the inner angle of the left orbit. Now a pulsating tumor of the size of a large almond extends from the supra-orbital notch to the bridge of the nose, and backward between the globe and the orbit. It has increased rapidly of late, and the mass has a feeling like that of enlarged and convoluted arteries. Pulsation is strong and heavy, with a thrill, diminished but not arrested by compression at various points of the tumor's circumference. Compression of the carotid does not materially affect the pulsation.

October 17, 1874. Operation. Three drops of a saturated solution of nitrate of silver were injected into the centre of the tumor by a subcutaneous syringe. Before the injection the tumor was firmly compressed against the bone above the orifice of the syringe, and held there for a minute or two afterwards. A marked venous congestion was immediately noticed in the vicinity of the tumor. — P. M. The swelling has extended to the frontal region; eyelid congested.

October 18. Tumor perfectly hard, without pulsation. Left eye closed by the swelling of the lids. The latter were scarified. Some frontal headache.

October 23. Lids opening. General swelling diminished; red but less tender.

October 29. Swelling larger and fluctuating. Eye again closing.

October 30. Gland in front of right ear and one under left jaw swollen and tender. Pulse 100. Temperature 99.5°.

November 4. Temperature normal. The site of the tumor

is occupied by a large and fluctuating swelling. Glycerine plasma was applied over the tumor to soften the cuticle where the pus seemed to be pointing.

November 5. The abscess was spontaneously evacuated near the inner canthus.

November 12. The patient was discharged at her own request.

December 12. The patient returned for examination. The place filled by the tumor is now occupied by a firm cicatrix everywhere adherent to the bone.

THE MODERN ART OF PROMOTING THE REPAIR OF TISSUE.[1]

THE new art of promoting repair of the animal tissues combines the so called antiseptic method with other expedients hardly less important. Its object is to facilitate cell growth and cell transformation. This it accomplishes in a remarkable manner.

Antiseptics arrest decomposition in all stages, — not only advanced decomposition, characterized by odor, but also the beginning of the process, which dates from the introduction of germs through the atmosphere. With germs we have putrefaction or fermentation; without them we have none. These germs float, in small proportion, among the particles which are visible in a sunbeam. The object of the antiseptic method is either to destroy their vitality, or, by filtering the air, to exclude them. The process gets to be a matter of routine, and of a dozen methods of accomplishing it there will always be, as at the present time, a best and latest one. But whatever be the means employed, no half measures suffice.

I doubt whether any surgeon approaches certain machinery of the antiseptic method for the first time without distaste. It flatters neither the vanity nor the scientific sense to exorcise an invisible enemy with something very like a censer. But after two years' experience I have accepted the new doctrine with most of its details. I have learned that, what-

[1] A Lecture delivered before the Medical Class of Harvard University, in 1876. Boston Medical and Surgical Journal, June 5, 1879.

ever be his method, the duty of the surgeon is to act as if all the particles made visible by a sunbeam were noxious, falling like snow-flakes during every operation and every dressing, seeking to insinuate themselves into the wound at every crevice. His aim should be to destroy the actual intruders, and effectually to exclude their thronging companions.

While partial measures facilitate repair, and a pure air promotes it, there can be no question that the average result is signally improved by a thorough "antiseptic" dressing, and that the worst cases often thrive under it in a way hitherto wholly unexampled.

Let us first give the credit of this new art to Mr. Lister, and then look briefly at the theory and its surroundings.

Like other germs, the germ of knowledge, in the form of suspicion and hypothesis, is always floating in the air. He who first assembles imperfect and detached ideas, and by their means establishes a proposition beyond a doubt, and then brings his demonstration home to the conviction of the world, — a measure which is all-important to his claim, — has fulfilled every condition essential, not only to the private and secret discoverer, who has no claim to the world's gratitude, but also to the public discoverer, who lays the world under obligation, and is on that account recognized by it.

Lister is entitled to the merit of inventing a new and invaluable system of promoting repair. Antiseptics and drainage had indeed long been known, but upon these expedients Lister erected an entire art, developed it, and taught it with untiring perseverance till it was recognized. To Lister's hypothesis belongs the additional merit of being no accident. It had a distinctly scientific source in the experiments of Pasteur.

Pasteur, as many of you know, showed that decomposition

occurs only where certain microscopic organisms are present. He further showed that the germs of these organisms always exist in the atmosphere, and that the organisms reproduce themselves. If you exclude them, decomposition does not take place, and, so far as we know, cannot do so.

Tyndall repeated Pasteur's experiments. His glass box is familiar. Painted inside with some adhesive substance, it was allowed to stand until the particles in the contained air had settled or adhered. When a ray of light, traversing the box, showed that there were no particles to be illuminated, decomposition no longer occurred therein. Any animal or vegetable fluid sterilized by heat might remain in it for months unchanged. On admitting the atmosphere, with its dust glistening in the sunbeam or the electric ray, organic fluids became at once putrid.

There is another familiar and more curious experiment. Let an organic fluid be placed in a test tube, the mouth of which is attenuated for a few inches and bent to a zigzag form, but left open. The air drawn in and out, as the temperature changes, seems to lodge and leave its germs at the angles. At any rate, in such a tube boiled urine will not putrefy for years. Break the little tube so as to admit air freely with its particles, and putrefaction occurs at once. This experiment is the more curious because it would seem probable that the germs cannot be all excluded from the tube, but that a few must pass in when the cavity inspires air at every decrease of temperature, — just as dust insinuates itself under the crystal of a watch, or beneath a picture frame, streaking the engraving.

Whether we filter the air, and so strain off the particles, or annul their influence by antiseptics, or by extremes of heat and cold, the result is the same. Canned provisions are first boiled, and then hermetically sealed. The cook boils the syrup or ketchup, or roasts the meat, to keep them

from spoiling. Refrigerators are necessities of civilized life; and the modern brewer consumes many thousand tons of ice to cool his beer to a point which, while it allows fermentation to go on, will prevent an acetic or other unwished for change, and so keep it from spoiling.

The change here alluded to is a form of fermentation. All fermentation is distinguished by the fact that the height of the process is characterized by the greatest abundance of little organisms. When the fermentation is over, they die and fall to the bottom, and the liquid becomes clear. This happens also during putrefaction, and is considered evidence that the latter may be a form of fermentation, dependent on the presence of a bacterium developed from a germ. Just as the fermentation of beer, for example, depends upon the presence of yeast, so putrefaction depends upon another ferment, of which particles floating in the air are the seeds.

But even if the germ should prove to be not the seed of a ferment, but only a coincident which science has been unable to separate from some other and essential mechanism of putrefaction, it is nevertheless its infallible measure and indication, and this is all the surgeon needs to know. He may be satisfied with the practical deduction that to prevent decomposition in a wound he must prevent the entrance of the active particles of the air.

Let us here dwell a little on the germ theory of diseases, which is sometimes discussed in this connection as a branch of the same subject. We have seen that putrefaction is doubtless one form of fermentation, just as the change undergone by wine, beer, and vinegar is another form. Now, because certain diseases have, like fermenting fluids, a period of incubation, of activity, culmination, and decline, and because they exactly reproduce themselves, or "breed true," it has been argued that they are also dependent upon some form of germ or ferment. And because in a very few dis-

eases, notably in splenic fever, Davaine and Pasteur have detected not only bacteria, but distinctive ones, essential to the disease, it has been assumed that all epidemics travel by the floating germs of their own bacteria.

Further than this, it has been maintained that, if common decomposition and epidemics are alike due to germs, then localities which are known to harbor and breed the germs of the one will be likely to harbor and breed those of the other; for example, that in a case of diphtheria or typhoid fever drains or water-closets where matter is resolving itself into its elements are most likely to harbor and breed the germs of these diseases with others.

A dung-heap near a well was supposed to explain a typhoid epidemic among those who drank the water. More remarkable still, an alleged typhoid epidemic among the customers of a certain milkman was said to be caused by the infection of his milk-cans, because they were washed in a river which, a mile or two above, flowed past a small quantity of human excrement from a typhoid patient on the banks. In considering such suppositions, we must not forget the array of negative facts that render them doubtful.

If by "material" agencies of disease we mean that its proximate cause occupies space and moves in it, we may be correct. The bulk of one spermatozoön may suffice to contain billions of specific atoms. But it is quite another question whether an eye or lens will ever be able to identify in the spermatozoön either the hereditary germ or the predisposing soil of gout, because it has discovered the bacterium of splenic fever, or the spore of pityriasis versicolor, or the itch insect, or the flea, or the African lion which follows an Arab village, or any other organism which gets its living directly or indirectly off the human race, singly or collectively, and is to that extent parasitic and noxious. We cannot too strongly remember that something very like decomposition

is going on everywhere inside and outside the human body, and that it does not usually produce any insidious effect.

It is proper to enjoin cleanliness and the removal of obviously predisposing causes, even without deciding whether the germs of diphtheria, or scarlatina, or yellow fever, infect a drain with their bacteria, or whether they develop in preference in the all-surrounding air, and thence devastate a town, or cross a continent, under conditions of which we know little.

I am quite willing to avow, after two years spent in devising new antiseptic details, most of which you have seen in the surgical wards, that I have come back to something very like Lister's method as the most convenient and efficient.

As no doubt some of you will be likely to try for yourselves experiments in this direction, and faulty ones perhaps, I cannot do better than briefly to refer to some of my own, with the reasons for them.

Disinfectants act in two ways. For example, chloride of zinc and salicylic acid act only by contact, and give out no disinfectant atmosphere. On the other hand, burning sulphur, chloride of lime, solutions of chlorinated soda and carbolic acid, have a great advantage in generating a gas or vapor which disinfects the surrounding atmosphere.

Some of us remember that during the war travelling agents professed to preserve corpses. A person of this description came to our dissecting-room, and by merely painting the surface and injecting the orifices of a dead body with a colorless liquid preserved the muscles from putrefaction for a period of six weeks in the months of July and August. I soon found this "paint" to be carbolic acid. Its extraordinary preservative properties, which are easily demonstrated upon meat, make it on the whole the best antiseptic for surgical use.

Mr. Lister's first article was published in the spring of 1865. In the autumn of that year, Dr. Beach, then my house surgeon, dressed a couple of amputations in the way described by Lister. They did well. But other dressings did well also, so that the new method was abandoned.

Two years ago, however, the evidence had so accumulated that I set fairly to work to try the experiment again, beginning with what seemed the most reasonable. I thoroughly washed lesions and wounds in a carbolic solution, covered them with a cloth similarly wet, and then with rubber cloth to hinder evaporation. They did better than those otherwise treated.

My next step was to introduce the distinctive principle of non-disturbance. The late Dr. James Jackson remarked to me when a student, that he was satisfied that surgeons were mistaken in adopting the then prevailing notions in regard to dressing wounds. He had himself seen better results when a wound was undisturbed, even at a sacrifice of cleanliness, than when it was daily dressed. It was in pursuance of this hint that, more than twenty-five years ago, as I was lately reminded by a former house surgeon, unless there were untoward symptoms, I usually left the bandages upon an amputation so long as a solution of chlorinated soda frequently applied to the outside would keep them odorless. The rule of non-disturbance was here enforced. Consider for a moment what must be the tendency of an opposite treatment, when newly formed cells are daily washed with alkaline soap, perhaps dabbed with a sponge, or killed by a mass of charpie saturated with some alcoholic solution to stimulate them. It is a little remarkable that under such treatment wounds heal at all. In short, I was early persuaded that the menstruum best adapted to the multiplication and transformation of cells was the fluid in which they are normally found, — that a pus or lymph dressing was the best;

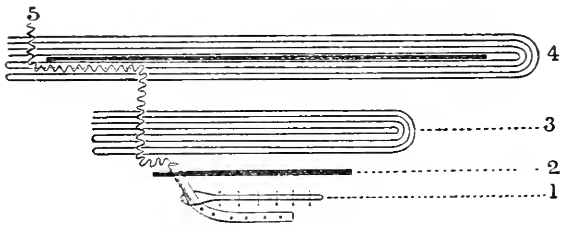
and my efforts were directed towards keeping this pus from decomposition. I now again attempted this.

A compress, wet as before in a carbolic solution of one in sixty was applied to a wound, and covered with rubber to prevent evaporation. Beneath it a tube was inserted for the injection, twice a day, of the same carbolic solution. This dressing could be left without renewal for a week. But the trouble of frequent injection was not its only imperfection. The surface of a cloth is too rough and absorbent to be placed in contact with growing cells, and they will be seen to multiply faster after the cloth has been floated off the surface by a thin layer of pus. To obviate this difficulty, gold-beaters' skin was interposed in contact with the granulations. Its soft surface was all that could be desired: but, unluckily, two days sufficed to dissolve it. Carbolized bladder was next tried, and did well, but proved a little stiff and dry. Curiously enough, the growing cells ("wandering") penetrated its moist surface, so that when it was raised they were torn off and bled. I now adopted the smooth but impenetrable surface of oiled silk. This answered admirably, and I had at last reached the expedient long before employed by Lister.

Under such a dressing a wound not only exudes the thin layer of fluid in which cells thrive, but its surface and margin become as uniformly smooth and glassy as the oiled silk which protects them. Such a surface contrasts strongly with the inflamed and corrugated exterior of a lesion dressed, for example, with charpie and tincture of myrrh. The cell transformation is now the very horticulture of repair. The pink cicatricial edge rapidly contracts around the wound. Besides this, if you desiccate the surface by blowing upon it, you discover a concentric glistening film of cuticle, previously invisible, which may attain, in a large ulcer, the extraordinary width of a quarter to three quarters of an inch in a week, — preparing the way for the cicatrix which fol-

lows. Such is the result when the surface has been flattened and polished by the glazed and impervious surface of oiled silk, while the atmospheric germs have been effectually excluded.

This exclusion being a fundamental condition of success, we will now consider the method of its accomplishment as practised and prescribed by Lister. A diagram will make this plain.



1. Represents a wound containing a drainage tube.

2. Is a protective of oiled silk in contact with the wound, overlapping its edge, and traversed by the drainage tube.

3. A layer of folded and carbolized muslin, which largely overlaps the protective.

4. A final layer of folded carbolized muslin, containing a thin rubber cloth. The latter has the distinct duty of diverting the discharge and delaying its direct progress to the surface. It thus retards decomposition, which occurs in the fluid soon after it has soaked its way to the air, and is then rapidly communicated to the wound.

5. Represents the path of the discharged fluid, when diverted by the rubber cloth.

Such a dressing may be wrapped about the extremity of a stump, or carefully fitted to the curved surfaces of the chest and shoulder, — after excision of a breast, for example, — and the whole is then bandaged.

A dry spot of discharge appearing on the surface of the

bandage may perhaps be overlooked. But if the discharge soaks through it, and the stain grows larger, the whole dressing must be renewed at once. This happens the day after the operation; then perhaps several times in a week; later, more rarely. It is desirable that the carbolized covering should exert an antiseptic influence for many days, or, as sometimes in a knee excision, for several weeks, without renewal. This is the object of the muslin, a porous and cheap fabric impregnated with carbolic acid, which is mixed with rosin to hold and slowly deliver it, and with paraffine to make the rosin flexible.[1]

Briefly to recapitulate. The wound is covered with oiled silk, and with fifteen or twenty layers of carbolized muslin containing a rubber cloth, and then bandaged. Every precaution is taken to prevent the contact of germs, whether during an operation or a dressing; the wound, the skin, the cloths, the surgeon's hands, the instruments and sponges, being all repeatedly washed in a carbolic solution.

The atomizer, which blows a cloud of spray of the strength of one in forty upon a wound, whether during an operation or a dressing, is an essential feature of Lister's method. It certainly adds nothing to the immediate comfort of the surgeon. But it seems to be an available substitute for a part of the washing and slopping incident to the use of antiseptics in a fluid form, and is in that respect a great con-

[1] The following is the method of making the carbolized muslin: —

Crystallized carbolic acid	one part.
Common resin	five parts.
Solid paraffine	seven parts.

Melt the two latter in a water bath, and add the acid while stirring.

The muslin employed in our Hospital is of cotton, and known as Colerain, or strainer cloth.

The hot mixture is sprinkled upon the muslin with a large brush. To further diffuse the carbolized mixture, the muslin is then folded small and subjected to pressure in a tin can for several hours, at the temperature of boiling water.

venience. This is especially true of a dressing in bed. Its efficiency could hardly have been anticipated, but there is no reason to doubt it. Lister seems to have first tried a jet of fluid.

The result of a complete Lister dressing, spray included, is sometimes marvellous, — as, for example, in a resection of the knee, which may require to be dressed two or three times during the first ten days, and only as often during the next two or three months.

Other methods will in time doubtless supersede it, but there is no reason to suppose that its principles can be neglected without largely impairing the average result. The fighting manual of exclusion may change from year to year, but an uncompromising hostility to germs will continue to be an abiding article of surgical faith.

We are now to consider another point of great importance. Fluid contents accumulate in a closed wound. If you remove a fatty tumor from the back, you will find it difficult to get a permanent union by first intention. A sanious fluid collects beneath the uniting integuments, and the wound becomes an abscess. This often happens after excision of the breast, or of tumors under the angle of the jaw, or beneath the flaps of an amputation. Ligatures and stitches encourage such abscesses, and are often responsible for them.

It is therefore a cardinal point in the treatment of every closed wound to evacuate this sanious fluid by inserting in the wound, before dressing it, a "tent" around which the flaps may heal. Such a tent is a small rubber tube perforated with holes, introduced at a dependent part of the incision, deep enough to insure drainage. It passes through the oiled silk protective, and is then cut off and secured by a string, so that it may deliver the fluids outside the silk into the muslin. Every considerable sinus afterwards occur-

ring about a wound must be thus drained. During the healing of a wound nothing is so insidious as the burrowing of pus, which may occur even when it is not wholly imprisoned. It travels by its own weight. I have formerly and repeatedly impressed on you the necessity of free incisions for its evacuation at the nearest surface which it is safe to cut. In these days such incisions should be tubed, and their interior injected and carbolized. If you cannot cover them with antiseptic dressing, let them be carefully and thoroughly injected with a carbolic solution of one in sixty, or one in forty, twice a day, and placed under a carbolic drip.

The drainage tube is withdrawn gradually and slowly, in view of the fact that any premature closing of the interior surely results in abscess.

Horse-hair and other materials have been suggested as substitutes for the rubber tube, but not, as I think, with advantage.

Although a common silk ligature, cut short and left upon an artery, after some months decomposes and disappears, cat-gut, when carbolized, and whether employed as ligature or stitch, deliquesces in a few days, and so repays the trouble of its use. Once applied, it needs no thought, and in fact generates in its immediate neighborhood a wholesome carbolic atmosphere.

If you have no atomizer, drench a wound or compound fracture inside and out with a carbolic solution of one in forty; or wipe it out and pour in carbolized oil,[1] as originally recommended by Lister in the treatment of compound fracture, and then get the wet and ample dressing quickly into place, with oiled silk next the wound; or, if you have none, wet and carbolized cotton batting, or folded cotton cloth, or both. A limb thus dressed, or even without

[1] One part carbolic acid in six to fifteen parts of linseed oil.

dressing, may be placed under a drip, as in the two cases of open knee joint in our wards, where a wick-yarn siphon leads the antiseptic fluids to a cloth lightly laid on the gaping wound, while another below the limb conducts it from a rubber sheet to the floor. On the body a drip is less available than on a limb. You may remember that burnt flour is an old and good dressing for certain ulcers. Carbolized sawdust or bran has been advantageously substituted for flour upon a carbolized wound.

Guerin's cotton wool dressing effectively filters the air, especially if the inner layers be wet and carbolized. But the outer and dry layers should be several inches in thickness, and largely overlap the wound or wrap the limb. The surgeon undoubtedly obtains excellent results by Guerin's method, the carbolic element, which adds greatly to its efficiency, having been adopted from Lister.

When a large surface has been dressed with a carbolic lotion for a considerable time, the system may suffer from its absorption. The most striking toxic indication is a dark bluish green color in the urine; there is also prostration. It is then necessary to discontinue the carbolized fluid. Salicylic acid may be substituted.[1]

I have purposely deferred until the conclusion of this lecture two matters of importance. The first is the relation of repair to the pulse and temperature; the second, its relation to coagulum. The first of these points has great practical interest.

In the old method of dressing wounds, hemorrhage and

[1] Water dissolves only about one part in three hundred of salicylic acid; but the addition of eight parts of borax to boiling water enables it to dissolve ten parts in one hundred. Alcohol dissolves salicylic acid, and the solution may be then mixed with water to impregnate cotton wool. The addition of a little glycerine keeps the pungent dust from the atmosphere, if the cotton be used when dry.

suppuration betrayed themselves on the surface. But you will ask, as I did, How can we ascertain whether a mass of antiseptic covering may not imprison or conceal an abscess fatal to union, and possibly disastrous to the patient? Fortunately, an abscess in the wound unfailingly and at once reveals itself by an elevation of pulse and temperature. An abrupt ascent of the previous zigzag lines of a carefully kept chart peremptorily directs attention to the wound and to a renewal of the dressing.

Such an abscess must be at once freely evacuated, carbolized, and tubed, whether it be again protected by a close dressing or by a lighter antiseptic covering.

When dealing with a wound which is to be covered by integument, the surgeon cannot exercise too much patience in tying all the vessels. Fluid may, notwithstanding all his care, collect in the cavity. The mere washing of a freshly cut surface with a carbolic solution of one in forty excites the capillaries so that effectual drainage becomes essential. In a closed wound we aim by the careful drainage of blood and serum to secure a permanent contact of the surfaces. But in an open wound a coagulum may be turned to good account. Its exact behavior is less important. Physiologists incline to the opinion that it does not itself become transformed, but that new tissue penetrates into its interstices. It may thus become an admirable dressing, provided only we prevent its death and deliquescence. This is quite possible by thorough antiseptic protection.

THE MODERN ART OF PROMOTING THE REPAIR OF TISSUE.[1]

THERE can be no doubt that antiseptic dressing is attended with a largely diminished mortality in any hundred consecutive surgical cases, whether in a hospital or elsewhere. The experience of surgeons has further confirmed the doctrines of Lister, and, if it has not added much to the art of antiseptic treatment, has shown better what is essential in the method, and how to secure it. Indeed, the theory is so convincing, its principles are so few and their application so easy, that repair might seem to be absolutely within the control of the surgeon.

But this is not the fact. Practice shows that wounds will not always do well. The surgeon fails less often perhaps in engineering a difficult case than in adapting to a common one some simple detail connected with drainage, stitches, the ligature of arteries, the opening of a sinus, or other matter of routine; the problem being as simple as a sum in addition, but as easily and fatally deranged. It is still inevitable that the results of Listerism, in spite of precaution, should be sometimes unsatisfactory.

Surgeons still rely mainly on carbolic acid. A year ago (1876–77) you saw thymol used in my surgical wards with excellent results. As less irritating to the hands, and of a more agreeable odor, it may be used advantageously in spray, but in the regular dressing I employ carbolic acid, and resort

[1] Second Lecture, delivered in 1878. Now first published.

to thymol and salicylic acid only as substitutes when toxic symptoms compel its discontinuance.

A careful, persevering attention to drainage, as demonstrated by Lister in England and Chassaignac in France, which may be practically included in the antiseptic method because it removes what most readily decomposes, cannot be too strongly enjoined. We can dispense with neither, but if compelled to relinquish one, I should hesitate between drainage and antiseptics.

Nine times in ten a closed wound heals outside before it heals inside; the integuments unite before the flesh, and then fluid may collect in the cavity, — whether blood from an untied artery, oozing from capillaries, or exuded lymph. This fluid, if imprisoned, is very fatal to union, converting the wound into an abscess, and then involving the gradual ulceration of the freshly united edges. If a thigh is amputated for disease of the knee, perhaps a little pus has previously perforated the capsule and escaped among the muscles of the thigh into a cavity barely admitting the finger. So surely as the top of this little sinus is shut off and left in the stump undrained, and the integuments are brought closely together, so surely will the sinus become a formidable abscess, rapidly disintegrating the tissues high up, and even endangering the life of the patient. So an effort to save a crushed ankle joint or compound fracture of the leg often begets insidious intermuscular sinuses. The burrowing of pus, whether among the muscles or through freshly united integument, is the arch enemy of operative and traumatic surgery. Against it the surgeon has one efficient resource, which is to provide the cavity with a tent or tube to drain it, as a sewer does a cesspool.

Drainage is an art to be learned; and without some disastrous experiences you will hardly realize the nature of the accidents it is intended to avert. So important is the

evacuation of decomposable fluid that Koeberlé and Keith do not hesitate to evacuate collected fluid by means of a glass tube introduced into the depths of the pelvis during a convalescence from ovariotomy, if the temperature indicates mischief. But a difficulty incident to the classical Lister dressing is that, when the presence of an abscess is indicated by the chart of temperature, the mischief has been already done, the pus has already collected, and the cicatrix has begun to yield.

You will naturally inquire whether the antiseptic treatment is never compatible with a daily inspection of the wound and with a lighter dressing. In July of this year I was much struck with cases in Mr. Callender's wards at Saint Bartholomew's. In addition to draining and uniting a wound in the usual manner, this surgeon paints its interior with a large soft brush and carbolized oil; covers it with a strip of lint soaked in the same fluid, with a second larger strip similarly oiled, and, lastly, with gutta-percha tissue, all of which are kept in place by a light bandage. The daily dressing consists in the removal and renewal of the outer lint alone, the inner layer being carefully left in place, and only freshly painted. A wad of charpie at the orifice of the drainage tube is also carefully replaced. The use of carbolic oil is not new; it was largely employed by Lister in his earliest experiments, and this dressing, which is both rapid and painless, is capable of accomplishing remarkable results. I saw in Mr. Callender's wards two cases in which the internal condyle of the knee had been detached by a narrow saw introduced from above (the operation of Armadale, Ogston, and Almy). What became of the sawdust and blood effused in the joint I do not know. But the cases were in full tide of recovery, with only the dressing I have described; and although I still feel that so simple an additional guaranty of immunity should not be omitted, I confess they have somewhat shaken

my previous creed respecting the use of spray in such operations on the knee joint. I may mention, incidentally, that Mr. Callender employs in amputation a suspended hinged splint, by dropping the front of which the stump is exposed, and dressed in the way I have described with little or no pain.

But let me call your attention to a still more striking class of cases in the practice of Koeberlé of Strasburg. This distinguished operator, well known for his success in ovariotomy, uses neither carbolic acid, nor other antiseptic, relying mainly on excessive cleanliness.[1] I was anew reminded of the extent to which success in operative surgery, literally "the work of the hand," may sometimes depend upon the frequent examination of the progress of repair. In the service of Koeberlé, wounds are uncovered twice a day by the surgeon himself. During the operation, dry clean towels in great abundance are used as substitutes for sponges; the lips of the wound are approximated with great accuracy, and united by sutures less than half an inch apart, as well as by another expedient to be described later; and the drainage tube is of glass. Charpie is loosely heaped along the line of union, and covered, not with a bandage, but with a single band or belt, which can be at once opened by removing pins. Twice a day this band is unfastened, the charpie removed, and every particle of moisture, every speck of discolored blood, wiped from the surface and interstices, as well as from the orifice of the drainage tube, with bits of dry charpie. Here, without antiseptics, but with excessive cleanliness, is the personal exercise of great surgical tact and practical skill, insuring the earliest attention to emergencies and their prevention; in short, the active supervision and guidance of repair as if it were a chemical experiment, and not a growth under the ground, to be looked after at a certain interval.

[1] It is stated that Koeberlé has since employed carbolic acid.

The exercise of such elaborate care and skill is wholly incompatible with the exigencies of a large practice, or the possibilities of a hospital where house officers are generally overworked, and come to learn rather than to lend a matured judgment and experience; but contrasted with the routine dressings of common hospital wards, or even with a routine antiseptic dressing, it furnishes matter for profitable study. I believe that each of these systems will some day gain a substantial advantage by the adoption of something from the other.

Let us now revert for a moment to theoretical considerations. I have formed no opinion upon the relation of bacteria, whether specific or not, to septicemia, to pyemia, or to so called blood poisoning. They are sometimes, like erysipelas, quite prevalent in the wards, and sometimes absent for months or years. Their existence has by no means an exclusive connection with lack of cleanliness. You cannot produce abscesses in the joints, nor inflammatory spots in the lungs, by allowing a wound to become surrounded by maggots, for example. On the other hand, patients with every care, healthy, and with no clear provocation, are attacked with pyemia.

All this will perhaps be understood at no distant period, and in the mean time I prefer to suspend judgment. But with the bacterium present in decomposition the evidence is more complete, and certainly leads us to think that Pasteur may have here identified the proximate mechanism of the process. It plays a most important part in nature. Just as the vital spark endows the elementary ammonia with new capabilities in the form of protoplasm, so when vitality, under any name, leaves the plant or animal, it is the duty of this bacterium to decompose the protoplasm into its integral ammonia, and the whole material world is thus at last reduced into atoms by the agency of this organism, which seems to

be always contending with vitality for the possession of the living cell, and which, as an uncompromising enemy of living things, is a more suggestive emblem of mortality than Time with his scythe. Minuter than the infusoria of the ocean, its labor evolves products more vast than the limestone rocks built out of the remains of those microscopic animalculæ. It is the province of the surgeon to contend against this insidious and omnipotent foe. The thesis that now only waits for complete confirmation is, that where there is a fair reparative power wounds will always and inevitably heal in the shortest time and in the most favorable manner when the bacteria of decomposition are absolutely excluded.

We must look to the laboratory for the crucial experiments relating to the action of bacterial germs upon organized fluids which shall show us how best to effect their exclusion. It is there recognized, I believe, that germs adhering to natural objects are a more important factor in experiments, and require greater precautions for their extinction, than those which are usually floating in the air. In other words, that while atmospheric germs are so few and far between as to justify the surgeon in taking an inconsiderable risk in respect to them, they are liable to accumulate in surface dust and dirt to a degree that makes it peremptory to destroy them. If this be true, the success of the antiseptic practice, already quoted, of Callender and Koeberlé, is partially explained. It depends largely upon absolute local cleanliness, and the practical extinction of germs upon the part itself during and after an operation by a machinery which does not interfere with cell growth, as did the soap and water of a conventional but less efficient procedure. It also points to a similar cleanliness of the surgeon's hands, operating coat, instruments, and sponges.

A few experiments upon meat will satisfy the observer that is it difficult to determine exactly what should be the strength

of an antiseptic solution, because, although certain bacteria can be identified and killed under the microscope, yet a germ is more tenacious of life. It is less easily distinguished from the surrounding molecular matter, and in fact can only be distinctly identified by its power to contaminate other fluids. Upon this question which relates to the efficiency of antiseptic solutions we must be satisfied with approximative evidence. Indeed, this question has not been practically solved by Lister, nor can any exact rule be laid down for the selection of an antiseptic dressing.

Something may be predicated upon the shape of the wound, and something upon its locality. If, as in the excision of a knee joint, the subsequent adjustment of the parts requires time, and especially if, as there, the wound itself is so devious that, after a protracted exposure to the atmosphere, we cannot be sure that every crevice is searched by a final antiseptic washing, then it is better to use the preventive spray throughout the operation, and to finish with a complete Lister dressing. This is the more true if such a dressing can be readily applied, as around a limb or stump. So in the operation of ovariotomy the abdominal cavity is a series of deep interstices to which antiseptic prevention by spray is eminently adapted. The surface of the trunk also can be readily invested afterwards with gauze and cotton. In one case, which in the end proved successful, where the adhesions were all but universal, and the oozing had been considerable, I was unwilling to rely on spray alone, and filled the abdominal cavity just before closing it with a warm carbolic solution of one in eighty, and then turned the patient over to drain it thoroughly.

If the wound is flat or superficial, and can be thoroughly washed a second or two before applying a dressing, then I believe spray to be less necessary. In a smaller wound also a light antiseptic dressing, like that of Callender, may prove

efficient. Upon a breast it has the advantages of being easier to apply, and more comfortable to the patient. A greater accessibility of the wound enables the surgeon to examine it oftener, and to meet emergencies earlier; in short, sometimes to preserve union when endangered by abscess and ulceration.

If the great aim of the new method is the healing of wounds, we may perhaps advantageously review some of the other expedients contributory to the success of antiseptics and efficient drainage, and which in combination with these subserve what I have called the modern art of promoting repair of tissue.

Before operation the integuments should be shaved and thoroughly washed with a carbolic solution.

Incisions should be calculated with reference to a subsequent comfortable position for the patient in bed, so that the place of the drainage tube shall be habitually a depending one.

Leaking of the wound should be prevented by every possible expedient; in amputation, for example, by clean continuous cuts, avoiding small muscular incisions in the depths of which oozing may occur. Every vessel should be sedulously secured. Large catgut is liable to slip off; small catgut may deliquesce too soon; so that while the unimportant vessels are tied with the finer gut, and the principal artery with a larger size, the latter may be reinforced for security with a ligature of sewing-silk cut off short and left for absorption. It would be wise if every wound were kept open a quarter or half an hour under antiseptic protection, or even otherwise until dry. I should not omit to mention the expedient originating with Koeberlé, though since claimed by others, of compressing the smaller vessels, as fast as they are cut, with forceps left hanging from the wound, a dozen or

more perhaps, until the end of the operation, after which it will be found that few of the smaller vessels require tying.

Another useful expedient in the practice of the same surgeon is that of packing a number of dry towels in contact with the oozing vessels of the peritoneum and intestines for a few minutes during or after ovariotomy. A dry cloth in any fresh wound similarly arrests oozing. So does the application of hot water. It is better to lay the drainage tube in the wound before closing it, than to thrust it into a hole afterwards, at the risk of displacing a ligature.

In operations upon the limbs, subsequent muscular rest should be secured by splints if necessary.

In approximating flaps two distinct points deserve consideration, their traction and their apposition. It is not safe always to rely on stitches to accomplish both objects. When these ulcerate and require removal, the union may not be firm enough to resist the tension of the flaps, which need support until united. Such support may be afforded in well known ways, as by an occasional wire suture an inch from the margin. Koeberlé uses with excellent effect loose cotton thread or "waste" between each stitch or two, spread out like a fan on either side and attached to the skin by collodion. Similarly I have used dentists' floss silk. In the large flaps of a breast or of an amputation, wires with shields and shot answer well; but thick flaps are liable to swell, as in a stump or in the perineum, and it will be essential to relax the wire after a day or two, for which purpose I have used a sliding screw clamp as a substitute for shot.

Ulcerating stitches rapidly and largely disorganize a new cicatrix. It is therefore better to remove them by the third day. But under an antiseptic dressing they may often remain a week, and under collodion still longer. A wire suture, such as I have spoken of, supported by a shield beneath which some lint is placed, and daily touched with a brush dipped

in carbolic oil, sometimes does not cut through the skin for weeks. Catgut stitches deliquesce beneath collodion, and if reinforced by floss silk tractors need not be removed at all.

The traction and the apposition of flaps are separate functions, and as traction upon stitches promotes their ulceration they may be antagonistic, and obviously require distinct appliances.

While a redundant flap is far better than a scanty one, a wound is easier to dress, especially by the open antiseptic method, if the integuments are flat, than if they are raised or corrugated, to which end they should be carefully cut and fitted so as to permit the lint dressing to lie smoothly. I cannot but think that for a breast, at least, Callender's method is best. If it is adopted for amputation, the corners of a circular flap should be trimmed when brought together, in order to round the end of the stump.

In dressing a wound, the cavity of which has suppurated, it should be thoroughly syringed with the carbolic or thymol solution and drained by a tube, and any uniting part carefully supported.

But in spite of all precautions the surgeon will be occasionally doomed to disappointment by the grandest ulcerative destruction of an extended union by first intention. It usually begins near the orifice of the drainage tube. I have had little success in arresting its progress, and am disposed to adopt, in dressing this part of the wound, the most rigorous antiseptic measures of prevention.

Except in a complete Lister dressing much is added to the comfort of surgeon and patient by substituting for the usual bandage a wide swathe, previously fitted to the part and brought together by pins or tapes so that it can be opened like a folding door, disclosing the mass of clean charpie under which is the lint or protective which lies in contact with the wound.

Before applying such a band or bandage, the oiled lint or protective over cavities and hollow curves should be padded by a mass of charpie, loosely thrown here and there, to secure by its distribution a uniform and elastic pressure in bringing together the walls of the wound and effectually excluding obnoxious agencies.

Such are some of the minor expedients the adroit use of which characterizes the skilful surgeon. It is no exaggeration to speak of them as the pawns whose judicious or unskilful work, after a severe operation, may easily decide the game of life and death. If through the agency of antiseptic influences, aided by these expedients, all wounds could be made to unite as the healthiest do, and to fill up as rapidly and completely as now and then happens, the surgical wards of hospitals would offer a different aspect, and require less care than at present. In the mean time let us thank Mr. Lister for the great advance surgery has lately made in this direction.

RADICAL CURE, WITHOUT OPERATION, OF A LARGE UMBILICAL HERNIA.[1]

MRS. B., Irish, thirty-two years of age, strong and healthy, weighs two hundred and thirty pounds. Seven years ago, after a third confinement, she discovered a slight hernia at the umbilicus, which increased in size until it became necessary to wear a binder to keep the protrusion in place. During warm weather the patient was in the habit of throwing off this binder, and there followed a constant increase in the size of the protuberance. Two weeks before her admission to the hospital it became painful, and its under side ulcerated from chafing.

November 4, 1880. On admission the hernia was of the size of a child's head, and its whole mass was red and inflamed. Manipulation caused nausea. There had been vomiting for five days before entrance, and no movement of the bowels for three days. After etherization only a small portion of the tumor could be reduced. The remaining part, which hung down toward the pubes, was then supported by charpie placed beneath it, and compressed and held in position by adhesive plaster. A poultice was applied over all. Temperature 102° F.

November 8. The hernia was again in part reduced, causing a slight amount of pain, and the strapping with adhesive plaster was renewed. The tumor was now about the size of a large apple. The bowels were spontaneously moved at this time, seven days after the first symptoms of strangulation. Temperature normal.

[1] Boston Medical and Surgical Journal, January 5, 1882.

November 14. Pressure was applied upon the mass of skin and its contents by means of a large cork with a convex surface, held firmly in place by adhesive plaster and a swathe.

November 21. The integument of the sac was puckered. It was of a dark color, but there was no tenderness or lack of sensation. The discoloration was probably due to ecchymosis from tight strapping. Examination revealed two distinct rings, — a large one in the place of the umbilicus, at its side a smaller one, which appeared to be directed toward the larger ring.

November 29. (Twenty-five days after entrance.) The sac has become invaginated, and the depression which occupies its place will hold an ounce and a half of water. The larger ring readily admits the forefinger. There is some tenderness.

December 2. Tincture of cantharides was injected into the cavity formed by the invagination of the sac, in order to blister its surface and cause adhesion.

December 18. Liquor ammoniæ (fort.) was injected and allowed to remain for several minutes.

December 26. Tincture of iodine (one part to eight of water) was injected.

January 3. The sac has lost its former tendency to protrude when the pad is removed.

January 21. Considerable suppuration from the invaginated surfaces, and much pain.

February 8. Liquor ammoniæ (fort.) again injected. The invaginated surfaces of integument appear to be growing together.

March 1. (One hundred and sixteen days after entrance.) Granulations are seen at the neck of the inverted sac.

March 19. Liquor ammoniæ (fort.) injected.

April 13. Interior of the inversion touched with nitrate of silver. A sinus still admits a probe.

May 15. A large, tight-fitting truss was applied over the ring.

May 25. (Two hundred and two days after entrance.) The patient sits up for a short time. There is no tendency in the hernia to protrude. The cavity formed by the invagination of the sac is entirely obliterated.

June 1. The patient walks about the ward.

June 6. (Two hundred and fourteen days after entrance.) Discharged well, although directed to wear a truss at present as a matter of precaution. The obliterated sac has evidently formed a pad upon the inside of the abdominal wall which occludes the umbilical ring.

FEES IN HOSPITALS.[1]

Whatever a medical officer may think of the right to receive fees from patients for services rendered within the walls of a charity hospital, there is no doubt that its practice would be detrimental to the institution. The writer desires to place permanently on record a few of the hitherto unwritten arguments against such fees.

The excellent general management of some of the American hospitals is well known. Their exceptional comfort, their careful nursing, and their elaborate equipment attract to them persons of a higher class than are generally met in such institutions abroad; among them patients, no matter what may be their disease, who are able to command all that is essential to their personal comfort and proper treatment elsewhere. Indeed, the question has been raised whether some of the American hospitals are not more elaborate than the friends of the poor, by whom they were established and are kept up, will permanently support. But there is another point which it is the object of this comunication briefly to discuss. In satisfying, by a certain luxury of accommodation not inexpensive to maintain, a class of patients who are able to pay their physicians, there is always the danger that such a hospital may drift from its original purpose, and become more or less a *maison de santé*, the first object of which is not so much the relief of the poor as the emolument of the practitioner. Medical men, notably specialists, often establish for their private patients very successful *maisons de santé*, but it is perhaps well to inquire how far

[1] Boston Medical and Surgical Journal, April 18, 1889.

what is advantageous to private interests may be disadvantageous to a large public charity.

The question of fees is not a new one, nor is it confined to Boston hospitals. In this country it is not uncommon to hear a physician or surgeon express the wish to be allowed to receive money from his hospital patient, and even his conviction that, under certain circumstances, it is proper he should; and it happens now and then that a hospital patient would prefer to remunerate his medical attendant. But it is safe to say that fees, however plausibly advocated, do not harmonize with the spirit of a public charity.

There are many objections to such a practice. In hospitals where there are patients by no means destitute, it would be difficult to restrict it. Permission to seek for a pecuniary remuneration would undoubtedly lead to an effort to secure it. And not from the well-off alone, for it is everywhere the willing patient that most readily pays his physician; the wealthy patient is not always liberal, and others may be liberal beyond their means. Emolument will be obtained where it is sought for. Should the practice begin in the private rooms, it would easily extend to the wards. If the collection of fees were allowed in a special class of diseases, it would be leniently sanctioned in other diseases.

Nor could the permission be confined to one class of officers without doing injustice to the rest. The patient, after paying his share of the current expenses of the institution and of the interest on its original cost, might, moreover, be asked to recompense not only his medical attendants, but other persons. The nurses, for example, would claim with justice that, if any service was to be remunerated by a liberal patient, their faithful attention was deserving of recognition; or, at least, that the training schools which supply the nurses should be remunerated for their outlay. The hard-worked house officers — who, except at the daily

visit, have chief charge of the patient, and who, especially in the surgical service, largely relieve the visiting officer of the onerous part of his daily duty, and upon whose fidelity the patient is dependent for his comfort — should certainly receive their share of any pecuniary reward. Indeed, if the attending physicians are to be authorized to receive fees, why should not the officers of the immense out-patient department be permitted to enjoy perquisites which now are not allowed. A very considerable practice might be established among patients in easy circumstances attracted to that department by the reputation of the institution, who could be retained as their private clients, or sent to their friends. The highest resident officer of a hospital, to whom all patients virtually apply, would also be justified in treating medically, out of the hospital, any or all rich applicants whose condition did not necessitate admission.

The answer to these suggestions is that a public hospital is a trust, originally set apart as a charity for the sick, and not for the pecuniary benefit of their attendants. Whatever in a charitable institution is practised for this end leads to its gradual insidious deterioration. Once allow fees and perquisites within a hospital, the institution would be legitimately worked for all it is worth, and patients who paid their attendants would be not the worst cared for.

In certain hospitals by-laws distinctly prohibit fees; but there are cases which by-laws cannot cover. Thus, if a medical man, because he has attended a well-to-do patient in a hospital, should charge him on that account an unusual sum for further attendance after he has left the hospital, no by-law can prevent such an imposition. The trustees should make sure that the patient while in the hospital is so far informed upon the subject that he shall not pay an excessive demand of this sort through a sense of supposed obligation incurred.

Let us at this point mention two extreme cases which are often urged by the advocates of a fee system. The first is that of a liberal or wealthy person, who, having met with a serious accident at the door of a hospital, and having been treated with skill and attention in its private rooms, proceeds to pay his bill. After remunerating the institution perhaps doubly, he next desires to pay his surgeon, and unexpectedly encounters a restrictive rule, which seems to be a great hardship to both parties. One hospital at least has provided, to our knowledge, a safety valve for this rare emergency. It virtually says to the patient, "Such a practice would not conduce to the general welfare of this institution. But we shall be grateful to you for a further contribution, and the money will be applied to the cure of some unhappy sufferer we should be otherwise unable to receive." There is no injustice in such an arrangement. The medical officer is fully compensated for his services without receiving fees. The distinction of holding his prominent position is well understood, the world over, to be ample remuneration, both indirectly in money and in other ways, for any professional service rendered by its incumbent. To be associated medically, and especially surgically, with a hospital in high repute, to share in the experience it affords, to stand as its representative at once before the medical world and the never ceasing current of patients who are often attracted mainly by its traditional reputation, is to be largely in debt to it. It has been said, with truth, that these hospital offices would command a considerable premium in money from the best class of practitioners were they annually put up at auction. If however it should ever be thought that its medical officers were not sufficiently compensated, it would be less objectionable if their claim should be for salary rather than for fees.

The other case, which not unfrequently occurs, is that of

a physician or surgeon who advises one of his patients to enter the hospital with which he is connected. The difficulty here is that every person who applies to a physician for advice, whether recently or not, becomes technically his patient. Indeed, as happens daily, a person directed by a country practitioner to a medical officer of a hospital merely to secure for him the advantages of the institution with which he is connected might, with customary propriety, be entered as his particular patient, and on that ground a fee could be asked from him. In short, a concession in favor of the physician of the right to take fees from his particular patient could be made to include anybody he might place in the institution.

It should not be forgotten that the outside profession must be considered. When the advantages of a hospital intended by the public as a trust for the poor are so organized as to divert patients, able to pay, from physicians who are not allowed to attend them therein, the outside profession have a clear right to be dissatisfied. In fact, they are quite alive upon this point, and have repeatedly expressed this feeling. The only justification of a hospital would be that the money of these patients went to its funds in support of its charities, and not to its medical officers.

Another point, relating to hospital attendance by a medical officer off duty, deserves to be looked at carefully. In Boston a medical officer has a permanent right to attend a patient out of his term of service. In other cities this right is usually an exceptional courtesy, temporarily conceded by the officer in regular attendance. Were it agreed that a physician might have patients in a hospital indefinitely, a practitioner of business ability could easily arrange for a permanent body of patients, drawn from a wide range of country, to be daily visited by himself with great economy of time and trouble, to be supervised for his benefit by hospital

trustees, to be nursed by the training school nurses and by hospital employees, at a much less expense than similar care would cost them outside the walls. Such an arrangement might enable the patient to pay his medical attendant readily; but this was not contemplated in the trust instituted by the founders of the charity. There may be occasionally a special reason for it, but a recognized habit of attendance on patients by medical officers out of their term of service, aside from the inconvenience it occasions to the administration, is a first step towards changing part of a hospital into a *maison de santé* for the benefit of the physicians. Add the right to receive fees, and the change is complete.

Lastly, though not least important, if a hospital is dependent upon legacies and charitable subscriptions, it should be able to go to the community with clean hands. No appeal in its behalf would excite much sympathy were it known that a portion of the money given was to enable medical men to collect fees more conveniently.

All this may be briefly recapitulated. Whatever diverts the property, the resources, or the conveniences of a charity trust, or the patients who seek aid, to the private advantage of its officers, is a form of the spoils system. If persons abundantly able to pay are to be from time to time cared for, — and there may be occasions, especially in surgery, when it is convenient to the physician or better for the patient, — while the charges should be such that no mere wish for economy would lead them to a hospital, their money should go to the general funds, and not to the officers. If the occasion to receive fees occurs rarely, the emolument may be easily foregone, but if it is so frequent that the right is worth contending for, that fact is an objection to it. Prevention is often the least troublesome cure; it is well to distrust any wedge which might open the way to fees.

The trustee of a hospital, often a much occupied business man, gratuitously devotes ill spared time to its service because it is a charity. The medical officer also can afford to be disinterested; he is already sufficiently benefited by his position, and is at liberty to resign it when it is no longer advantageous to him.

The views here recorded are held by many of the medical officers of our hospitals. They have undoubtedly contributed to the welfare of the institutions. Indeed, of one of these hospitals it was lately said, "Its traditions and its charities are at this moment as clean as are its walls and floors."

FROM PHOTOGRAPH OF ENGRAVING IN THE BIBLIOTHEQUE NATIONALE, PARIS.

From Photograph of Portrait
Owned by the Boston Society for Medical Improvement.

AN OLD PORTRAIT OF A SURGEON.[1]

It has occurred to me that the Society might like to hear the conclusions I have reached in an inquiry of no great importance, which, although it was made for my own amusement, and has occupied more time than I had expected, relates to one of our possessions.

The old portrait of a surgeon hanging on our walls and familiar to members, was bought at Leonard's auction rooms about forty years ago. The picture has a good deal of merit, and my own interest in it lies in the fact that, while bidding for myself, I ceded its purchase at his request to the late Mr. William Appleton, who soon afterward gave it to the Medical Improvement Society.

Some years ago, as a matter of curiosity, I tried to ascertain whom this picture was intended to represent, and to do so I availed myself of the kind permission of the Society to have it photographed. This was about a year before I incidentally learned from our librarian that anybody else felt an interest in the subject.

Why the picture received the honored name of Ambroise Paré, which has remained attached to it for nearly forty years, I never knew. The late Dr. Bethune told me, at the time of its presentation, that the portrait resembled one of Ambroise Paré which was in the folio copy of his Works then belonging to Dr. Holmes and now in the possession of this Society; and

[1] Read before the Boston Society for Medical Improvement, April 22, 1889. Boston Medical and Surgical Journal, June 6, 1889.

the trephine which appears in the picture is an instrument so connected with the name of Paré that it seemed in some degree to corroborate this view; although I may observe that the particular trephine here represented is not furnished with the safety guard, the *chaperon*, devised by that surgeon.

Further and more recent consideration of the subject was mainly that of two points. First, the question of resemblance or non-resemblance of the features in this oil painting to those of other portraits of Paré; and, secondly, the accessory evidence, chief of which is the supposed professorial robe in which the subject of our picture is painted.

In considering how far the features of the different portraits of Paré resemble each other, we are at once struck with the small size of the under jaw. Hardly one man in a hundred has as short a jaw as is represented in some of these portraits. Indeed, this abbreviated jaw is a characteristic of the most authentic portrait of Paré.

Now the portrait belonging to the Society has the same short jaw. It is very short indeed: a curious coincidence, which doubtless had its influence when the name of Paré was selected for it.

I am indebted for the accessory evidence which I shall be able to give, to M. Le Paulmier of Paris, the highest authority on the subject, who has written a most interesting and well known biography, entitled "Ambroise Paré d'après de nouveaux Documents découverts aux Archives Nationales, et des Papiers de Famille, 1885," and with whom I have been in correspondence for a year or more.

In the critical notice in his book of the existing portraits of Ambroise Paré, most of which are to be found in the different editions of his Works, M. Le Paulmier refers nearly all to a common original, an authentic oil painting of the great surgeon at the Chateau de Paley, and more directly to a well known engraving of Delaune, which he considers to have been

taken from that painting. In view of this common origin, it might be supposed, however inferior most of them are as works of art, that these various engravings would resemble each other; and yet, apart from the peculiarity of the jaw already alluded to, it is not easy to see at once how they can represent the same individual, or even to discover any resemblance between some of them but that of a short jaw, — and so far as that goes the portrait of the Society might be a genuine one. The evidence from such portraits as are accessible in Boston cannot be said to be conclusive. But some of them are upon the table, and gentlemen can form their own opinion about this.

Next, as the Society will remember, came the additional evidence of a superb portrait by Porbus, said to be of Ambroise Paré, representing a man of noble mien and fine expression, a photograph of which the Society owns. If this portrait were authentic, the Society's portrait could by no reasonable probability be supposed to represent Ambroise Paré, and to my own mind this new evidence seemed quite conclusive.

Unfortunately, on further inquiry, this fine picture attributed to Porbus turns out to be a portrait of another person. M. Le Paulmier says (*op. cit.*, page 134): "Some galleries possess pretended portraits of the illustrious Paré which represent wholly different individuals. I will only cite two, one which is in the Chateau d'Azay-le-Rideau, bearing the modern inscription, 'Ambroise Paré, born in 1517, surgeon of King Henry III.'; and another, a magnificent portrait belonging to Madame Nélaton, which figured at the late exposition of the Trocadero. This last is attributed to Pieter Porbus, and represents an unknown person." We must therefore leave this portrait out of the question.

In regard to the second point, — the supposed professorial robe or gown, — the question has been raised here whether

Ambroise Paré had the right to wear this robe. It was justly said, that, if he were not entitled to it, the presence of the robe in the picture would tend to show that this is not a portrait of Ambroise Paré.

But, on the other hand, if Ambroise Paré did possess the right to wear a robe, this argument is without weight, and we are left as much in the dark as before. I shall soon show that Ambroise Paré was entitled to wear one.

It is, however, possible to throw light on the whole question. I can at last fortunately present evidence of a conclusive nature that the portrait of the Society is not that of Ambroise Paré, by showing whose it really is.

I sent a photograph of our portrait to M. Le Paulmier, and, after a somewhat troublesome research, he was able to identify it. It represents François Hérard, a French surgeon of eminence who died in the year 1682. There is a notice of him in the "Index Funereus" of Devaux, a contemporaneous biographical dictionary of deceased celebrities. It says that he was "A man of signal integrity, of remarkable piety, and distinguished in art. He was one of those whose portraits were engraved by the order of Louis le Grand, and inserted among the portraits of men who were illustrious in art during his reign. He died December 24th, 1683." On page 50 there is a notice of his son, also a surgeon, who died before his father.

Our Society's portrait is this original one of François Hérard, painted by Siere, and engraved by Louis Cossin in 1682. The engraving is in the large collection of portraits at the Bibliothèque Nationale, where it was discovered in a search made at the instance of M. Le Paulmier. As another copy might possibly exist, the print shops of Paris were searched for one, but without success. Some months afterward I had another careful inquiry made, but equally to no purpose. There is a large collection of en-

gravings in Amsterdam. M. Muller wrote me that he had ten thousand engravings of physicians and surgeons, but none of Hérard. An unsuccessful quest was also made in London.

Of this engraving M. Le Paulmier writes me, that it is "a portrait of F. Hérard, bourgeois de Paris, member of the College of Surgery, born in Paris, and who died there December 24, 1682. The 'Index Funereus' is in error in saying 1683. The engraving of the Bibliothèque Nationale is like the photograph you sent me, and underneath it is a manuscript inscription mentioning his name and the date of his death, with his age. The portrait you possess is probably the original by Sicre. It is that of a surgeon who, if he has not left a marked trace in science, had during his life a brilliant clientele and an excellent reputation."

The title upon this engraving, however, being in manuscript, might possibly have been put upon the portrait of another person. I therefore ventured to write again to M. Le Paulmier upon this point. His answer will set at rest any doubts upon this question, and as it also mentions the fact that Paré had a right to wear a robe like the one represented in the Society's picture, I will with your permission read a part of the letter. The Society will notice that M. Le Paulmier has now discovered another copy of the engraving of Hérard.

"It is with real pleasure," he says, "that I send you the information I have collected in regard to your portrait of Hérard.

"The National Library possesses two identical copies of his portrait engraved by L. Cossin after a picture painted by F. Sicre, of which you probably possess the original.

"Except that the head is turned to the left, where we see a table supporting a skull, a trephine, and an elevator, these portraits are the same as that in the photograph you sent me.

They measure twenty-four centimeters in height, and nineteen in breadth.[1]

"The impression '*after the letter*' has, engraved beneath it, the following inscription: 'François Hérard of Paris, chirurgien juré, famous for trephining and other operations. F. Sicre pinxit, L. Cossin sculpsit.'

"The Père Lelong, who copies this inscription in his 'Bibliothèque Historique de la France,' adds, 'Deceased at Paris, December 24, 1682.'"

Thinking that the Society might like to see the original text of this allusion to their picture, of which a part has been cited by M. Le Paulmier from the "Bibliothèque Historique de la France, par Jacques Lelong, Paris, 1775," tom. iv., Appendix, p. 210, I have placed it upon the table. It reads thus: "François Hérard de Paris, Chirurgien, fameux pour les opérations du Trépan et autres; mort à Paris le 24 Décembre, 1682. F. Sicre p. — L. Cossin sc. 1682, in fol."

"The other impression, that '*before the letter*,'" writes M. Le Paulmier, "has no inscription but the names of F. Sicre and L. Cossin; but underneath, some one at the end of the last century has written, 'François Hérard, chirurgien de Paris, mort en 1683, agé de 87 ans.'

"Let us now consider the costume," continues M. Le Paulmier. "There were formerly two classes of surgeons. One, called short-robed (*de robe courte*), comprised the barbers, barber surgeons," of whom Ambroise Paré had been one. "The other, called long-robed (*togati*), included the master surgeons, or masters in surgery. These were members of the College of Saint Côme, and had passed a more rigorous examination than the others." It was this long robe that Ambroise Paré wore after his affiliation with Saint Côme. The significance of this affiliation will be better understood if we know what this society was.

[1] The picture is merely reversed by printing.

Saint Côme and Saint Damien were the patron saints of surgeons, and gave their name to the Chapelle des Cordeliers. This church of Saint Côme and Saint Damien, built in 1212, was one of two which occupied the extremities of the large area enclosed by the Rue de l'École de Médecine, the Rue Racine, and the Rue Antoine Dubois.

The surgeons were allowed to use the church of Saint Côme as a place of meeting for a society for medical improvement of the sixteenth century, (*devaient se réunir pour s'instruire mutuellement dans leur art,*) and also as a surgical infirmary for poor patients gratis, one Monday a month.

In the year 1515 the church of Saint Côme was converted by government decree into a surgical college. This was in part demolished in the year V. of the Republic, and was destroyed in 1836, except the Amphitheatre of Surgery, which in time became the Dupuytren Museum.

Section VIII. of the Introduction to Malgaigne's Complete Works of Ambroise Paré, Paris, 1840, is entitled "Transformation de la Confrérie de Saint Côme en Collége. — Reception d'Ambroise Paré." The account of this is interesting enough to be read here: —

"Under existing circumstances, the college had an immense interest to attach to itself Ambroise Paré, who was in so great favor with the King, of such great renown among the people and the nobility. In spite of the statutes which required that the candidate should know Latin, in spite of the edict of 1544 which insisted on this condition, more especially in spite of a difficulty greater than all the rest, the necessity of making him undergo his examination in Latin, everything was conceded and arranged in advance; they decreed to him — perhaps an unheard of thing — the honor of a free reception; and he asked, in consequence, to be admitted to the examinations on the 18th of August, 1554; he was named Bachelor the 23d of the same month, licensed the 8th of October, and

took the *bonnet de maître* the 18th of December, 'in templo D. D. Cosmæ et Damiani supra fontes.'"

Having landed the great Ambroise Paré safely among the *chirurgiens de longue robe*, in the bosom of the college of Saint Côme, we can now understand what M. Le Paulmier says of this robe: —

"It was this long robe that Ambroise Paré wore after his affiliation with Saint Côme, — as did also Hérard, — and, for that matter, most of those who figure in the 'Index Funereus' since Francis I. It was the official costume, which had no necessary relation with any other function; François Hérard himself had no title at court. This will explain (apropos of your question about Juvernay, who himself wore one) why mention is made of surgeons of the long robe, — *togatorum*."

Let me say that this allusion to Juvernay refers to one M. Stephanus Juvernay, whose name is in the "Index Funereus," and about whom I inquired of M. Le Paulmier, because he is especially mentioned as "embodying in himself the remains of the splendor of the school of surgeons of the long robe (splendoris Chirurgorum Togatorum scholæ reliquias in se complectens)."

I will add here that M. Le Paulmier quite understood that the picture about which he has so kindly interested himself belongs to the Society.

In conclusion he says: —

"I hope that I have replied to your questions in a satisfactory manner. If some point yet remains obscure, I place myself at your disposition. At all events it is perfectly clear, that, —

"1. The painted portrait of which you have sent me the photograph is that of F. Hérard, painted by Sicre.

"2. The two engravings of the Paris library were made by Cossin after this portrait.

"3. That the robe with which this personage is invested, as well as his collar, is of the second half of the seventeenth century, and such as surgeons then wore (*tels que les portaient alors les chirurgiens*)."

M. Le Paulmier has kindly volunteered to send me the engraving of Hérard, if a copy should ever turn up. In the mean time I requested Adolphe Braun et Cie. to make a photographic fac-simile of the engraving before the letter which has the written inscription concerning Hérard, and also of the leaves of the "Index Funereus" which refer to the Hérards. Of these I will ask the acceptance of this Society.

THE STORY OF A MEDICAL PORTRAIT.[1]

THE first paper in the present issue of the Journal is a short address recently read by Dr. H. J. Bigelow before the Boston Society for Medical Improvement, and entitled "An Old Portrait of a Surgeon." Preceding the address is a frontispiece giving reproductions from a photograph of an engraving in the Bibliothèque Nationale at Paris, and from a photograph of a painting owned by the Improvement Society. Unfortunately, the photograph and the reproduction from the photograph of the painting do not do it justice in its present restored condition; otherwise for purposes of comparison the print suffices.

Dr. Bigelow's admirable and critical address tells the curious story of the picture and of his final discovery of the name of the real subject of the portrait. For the full understanding of this matter by our readers, and that they may share the interest taken in it by the members of the Society to which the portrait belongs, it remains for us, availing ourselves of the facilities offered by the Society through its Secretary, to summarize briefly the discussions excited by this silent old portrait looking down on the Society's meetings, as we find them reflected in the records during the last forty years — discussions which would undoubtedly have been lis-

[1] Boston Medical and Surgical Journal, July 6, 1889. — Editorial.

tened to with varied emotions by the old French surgeon of the seventeenth century could he have stepped out of his frame and taken his seat among the Boston doctors of the nineteenth century. Their occasional animation would have caused a gratified smile; but things were said in the heat of debate which would have caused the shoulders to be shrugged in a way visible even through the academic gown. We refer, of course, strictly to discussions personal to the Portrait of a Surgeon, outside of which we are not authorized on this occasion to take the public into the confidence of the Society.

October 9, 1848. "Picture of Ambroise Paré. Dr. Bethune presented to the Society in the name of Wm. Appleton, Jr., Esq., this picture, which there is good reason to believe to be a portrait of this distinguished surgeon, painted during his lifetime." A vote of thanks was passed; and Drs. Bethune, O. W. Holmes, and H. J. Bigelow were appointed a committee to provide a suitable inscription for the picture. Whether this committee ever reported or not, neither the records of the Society nor the memories of living men declare; but, as a matter of fact, the frame of the portrait shortly after bore the inscription "Ambroise Paré," and as Ambroise Paré the old man with the skull and trephine continued tranquilly to assist at every meeting of the learned Society from that time until the year 1885, when a stormy period began, and the repose of thirty-seven years was broken.

February 23, 1885. "Dr. H. J. Bigelow asked permission of the Society to remove the portrait of Ambroise Paré in order to have it photographed. Permission was granted."

February 23, 1886. It was proposed and seconded that "the Secretary inquire when the portrait purporting to be of Ambroise Paré, and now in the possession of a member for the purpose of restoration, will be returned."

October 25, 1886. A letter was received from Dr. Bigelow returning the picture. It had been put in admirable repair by Mrs. William Appleton, widow of the donor, and a vote of thanks to Mrs. Appleton was proposed and passed. The new frame still bore the inscription "Ambroise Paré."

November 22, 1886. Dr. H. I. Bowditch said that the portrait owned by the Society, purporting to be Ambroise Paré, is the por-

trait of an inferior man with a retreating forehead. In the opinion of an artist whom he had consulted, the painting was of the middle or last part of the eighteenth century. He referred to the fact that a committee had been appointed in 1848 to investigate the picture and had never reported. He offered two resolutions: first, to thank Dr. Bigelow for his efforts to have the picture restored; secondly, to change the inscription so as to read: —

PRESENTED TO THE MEDICAL IMPROVEMENT SOCIETY BY
WILLIAM APPLETON, ESQ., IN 1848.

BY THE KINDNESS OF MRS. APPLETON
RESTORED AND REFRAMED IN 1886.

The first motion was carried, the second was referred to a committee.

December 13, 1886. The committee reported that, in place of the inscription proposed by Dr. Bowditch, an interrogation mark enclosed in parentheses (?) be added to the name of Ambroise Paré, and that a reference to documents on file respecting the authenticity of the picture be pasted on the back of the canvas. Dr. Bowditch objected, and moved non-acceptance of the report on the ground that the Society would be acting a lie if it continued the inscription. A lively debate, in which various members took part, ended in the postponement of the discussion of the committee's report to a subsequent meeting.

December 27. Dr. Bowditch requested a further postponement of the discussion.

January 10, 1887. Dr. Bowditch addressed the Society on the "So called Portrait of Ambroise Paré." He showed engravings and photographs of all the accepted portraits of Paré, which he had been at great pains and some expense to collect, and pointed out the want of resemblance of the Society's portrait to any or all of them. He challenged the authenticity of the picture as a portrait of Ambroise Paré for the following reasons: 1, the lack of resemblance to other portraits of Paré; 2, the professor's robe; there was no evidence that Paré ever was a professor; his ignorance of Latin would have prevented; 3, the inferiority of the face; 4, it was probably a picture of the middle or last part of the eighteenth century; 5, the picture was bought at auction, coming from no one knew where, and for nine dollars.

At the close of his remarks Dr. Bowditch offered two resolutions in place of the committee's report previously under discussion: first, that the Society is grateful to the donors for the original gift; the picture, however, is not a portrait of Ambroise Paré, but of an unknown professor of surgery, and should no longer bear the name of Paré; secondly, that the President be requested to have the present inscription removed, and the inscription previously proposed by Dr. Bowditch put in its place on the frame of the picture.

The Society, after renewed discussion, passed these resolutions of Dr. Bowditch, and rejected the committee's report.

February 14, 1887. Dr. H. W. Williams said that since the last discussion he had received from London a new book, called "The Healing Art," in which it was stated that Paré was appointed Professor of Surgery in the College of St. Edmé. It was not impossible that the picture might after all be Paré, and it might be necessary again to change the inscription.

Dr. Bowditch in reply said that it was singular that two such writers as Malgaigne and Le Paulmier (both biographers of Paré) do not mention that he was a professor of surgery. In fact, they both state that he was always contending with the faculty; and again his ignorance of Latin was an insuperable impediment.

October 10, 1887. Dr. Bowditch reverted to the statements in the book called "The Healing Art," cited by Dr. Williams, February 14. He reiterated the statement that there was no evidence that Paré ever was a professor of surgery; he could not find any evidence that any college of St. Edmé ever existed. The book called "The Healing Art" was unreliable; it was by an anonymous writer; it contained many errors, some very absurd ones; he had made several unsuccessful attempts to communicate with the author through the publishers, and he had been led to believe that the author could neither support his assertions nor find the candor to acknowledge his errors. In closing his remarks Dr. Bowditch said: "Meanwhile, however, our painting, though it can never bear the honored name of Paré, has some considerable merit as a work of art; it should be carefully preserved; and I will respectfully leave to the juniors of the profession the solution of the question, Who was this man who, notwithstanding the rather inferior

characteristics of the head, was undoubtedly a professor of surgery in some college?"

From October 10, 1887, to April 22, 1889, the portrait hung listlessly in the Society's place of meeting, no longer the centre of contention, or even of interest; still familiarly referred to, if at all, as old Paré, but proclaiming itself by the inscription borne since January, 1887, as the great unknown.

April 22, 1889, the Society's notices offered, among other announcements, that of "Remarks by Dr. H. J. Bigelow on the Portrait of a Surgeon"; after hearing which remarks the Society voted, on motion of Dr. Bowditch, that the portrait have inscribed upon its frame the name of François Hérard!

Dr. Bigelow asked the Society to authorize him to express to the erudite M. Le Paulmier of Paris the great pleasure which his skilful identification of their picture had given them.

It was so voted, unanimously.

We have tried to make this long story short, but do not doubt our readers will find it worth relating, though it lead them for the moment away from the direct consideration of practical medicine.